

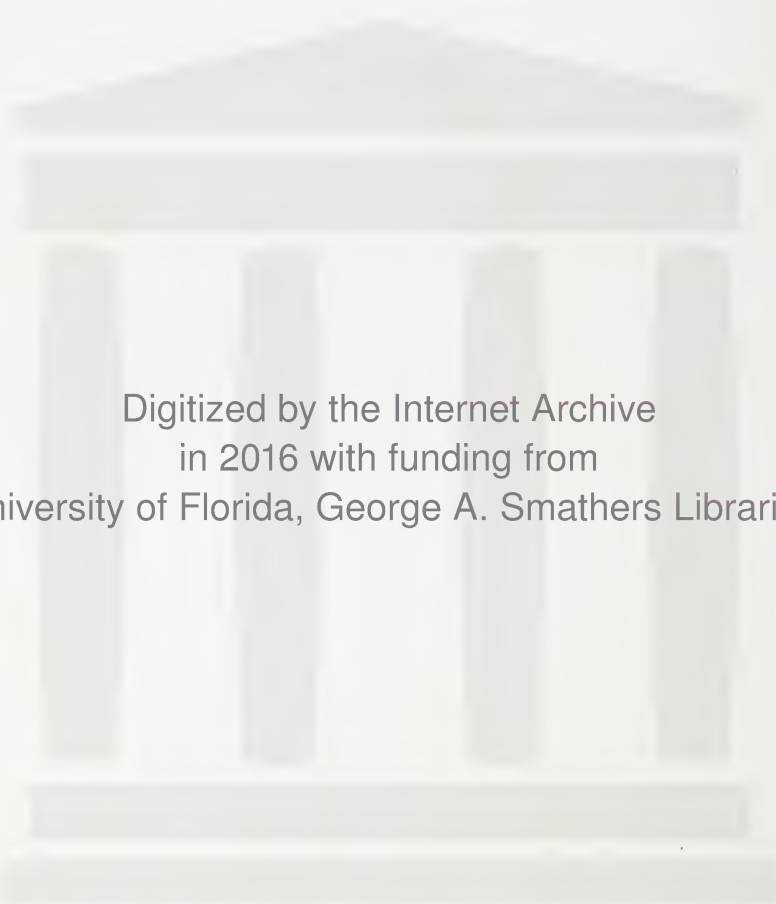
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UNITED STATES NAVAL ACADEMY

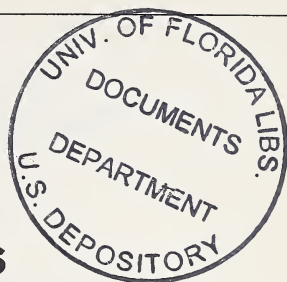


CATALOGUE 1965-1966



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FLARE



**UNITED STATES
NAVAL ACADEMY**

**CATALOGUE
1965-1966**



MISSION: To develop midshipmen morally, mentally and physically and to imbue them with the highest ideals of duty, honor and loyalty in order to provide graduates who are dedicated to a career of Naval Service and have potential for future development in mind and character to assume the highest responsibilities of command, citizenship and government.

CALENDAR

1965

27-29 August	Parents' Open House, Class 1969.
Monday, 6 September	Labor Day, Holiday.
Tuesday, 7 September	Leave and summer training expire for First, Second, and Third Classes.
Monday, 13 September	First-semester recitations begin.
Thursday, 11 November	Veterans' Day, Holiday.
Thursday, 25 November	Thanksgiving Day, Holiday.
29 Nov.-3 Dec.	Elective enrollment period.
Saturday, 18 December	Christmas leave begins.

1966

Sunday, 2 January	Christmas leave ends.
22-28 January	Examinations.
28-30 January	Leave.
Monday, 31 January	Second semester begins.
	Graduate Record Examination, First Class.
Tuesday, 22 February	Washington's Birthday, Holiday.
24-27 March	Spring leave.
Sunday, 10 April	Easter Sunday.
25-29 April	Elective enrollment period.
Saturday, 21 May	Armed Forces Day.
21-28 May	Examinations.
28-30 May	Leave.
Monday, 30 May	Memorial Day, Holiday.
Friday, 3 June	June Week begins.
Wednesday, 8 June	Graduation.
Wednesday, 29 June	Class of 1970 enters.

IMPORTANT DATES FOR CANDIDATES

1965

- July 1 The Navy Department begins officially accepting the names of candidates nominated for appointment in 1966.
- Physicals commence.
- During July, the U.S. Civil Service Commission holds the first of several competitive tests for Members of Congress who utilize this means of selecting their candidates.
- December 4 Administration of College Entrance Examination Board Tests.

1966

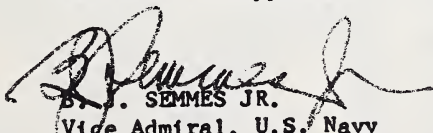
- January 8 Administration of College Entrance Examination Board Tests.
- January 31 Closing date for the nomination of candidates.
- March 5 Administration of College Entrance Examination Board Tests.
- March 15 Final decision reached on physicals by this date.
- May 1 Bureau of Naval Personnel begins to notify candidates of results of College Entrance Examination Board Tests.
- May During this month, the Bureau of Naval Personnel begins to issue authorizations to report for appointment as midshipmen to successful candidates.
- June 29 Date on which successful candidates are authorized to report to Naval Academy for appointment as midshipmen.

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	<i>Cover Photograph: H. L. Lynn, PH 1, USN</i>

Reviewed and approved:


B. J. SEMMES JR.
 Vice Admiral, U.S. Navy
 Chief of Naval Personnel



HOW TO BECOME A MIDSHIPMAN

Candidates for Admission to the Naval Academy Must:

- Meet general eligibility requirements
- Obtain a nomination
- Qualify scholastically
- Qualify medically

General Eligibility Requirements

Citizenship

All candidates for admission to the U.S. Naval Academy must be male citizens of the United States, except as provided by law for limited numbers of citizens of other American Republics and the Philippine Republic.

Age

Candidates must be at least 17 and not have passed their 22nd birthday on 1 July of the year of admission.

Marriage

Candidates must never have been married. Any midshipman who marries will be discharged from the Academy.

Moral Character

Candidates must be of good moral character.

Obtaining a Nomination

General

It is necessary for a young man to obtain a nomination in order to be considered for appointment to the Naval Academy. The sources of nominations are described below. The applicant should study carefully the various sources to determine those through which he is eligible to apply. College Board test results taken for purposes of qualifying for the Naval Academy apply to all nominations a candidate may hold.

Types and Sources of Nominations

Congressional. Each Senator, each Representative, and the Resident Commissioner of Puerto Rico individually may have a maximum of five midshipmen attending the Naval Academy at any one time. The applicant should address his request directly to the official concerned. Eligibility for congressional nominations is restricted by law to the two Senators from an individual's home State and to the Representative of the congressional district in which he lives. A sample letter of application is included on page 6.

Vice Presidential. The Vice President may have a maximum of five midshipmen attending the Naval Academy at any one time. He may nominate candidates from the United States at large. A letter requesting nomination should be addressed directly to the Vice President. It should contain the same information required of a congressional applicant.

District of Columbia. The Commissioners of the District of Columbia may have a maximum of five midshipmen attending the Naval Academy at any one time. Applications should be made directly to the Commissioners of the District. A letter requesting nomination from the Commissioners should contain the same information required of a congressional applicant.

The Governors of Puerto Rico and the Canal Zone each may have one midshipman attending the Naval Academy at any one time.

The Governors of the Virgin Islands, Guam, and American Samoa may collectively have one midshipman attending the Naval Academy at any one time. Applications to these nominating authorities should contain the same information required of congressional applicants.

Presidential. The President may appoint 75 midshipmen each year. These appointments are limited by law to the sons and adopted sons of officers and enlisted personnel of the Regular Army, Navy, Air Force, Marine Corps, and Coast Guard on active duty, retired, or deceased, but not discharged before retirement or death. Adopted sons to be eligible must have been adopted prior to their 15th birthday. The Secretary of the Navy is authorized to approve waivers of this policy where adoption proceedings had been initiated but the adoption had not occurred prior to the 15th birthday through circumstances beyond the control of the foster parents. Stepsons are not eligible. Applications should be addressed to the Chief of Naval Personnel, Navy Department, Washington, D.C., 20370. A sample letter of application is included on page 7.

Regular Navy and Marine Corps. The Secretary of the Navy may appoint 85 enlisted men of the Regular Navy and Marine Corps to the Naval Academy each year. These men must meet all of the entrance requirements and may not have passed their 21st birthday as of 1 July of the year of entrance to the Naval Academy. Applicants must have enlisted prior in the Navy or Marine Corps on or before 1 July of the year preceeding the desired date of entrance to the Naval Academy. All applicants must attend the U.S. Naval Preparatory School in order to compete for these appointments. Since the selection of candidates for this school begins in the spring, enlisted men who fulfill the age and service requirements should make their desires known to their commanding officers as early in the year as possible. Recruits enlisted prior to 1 July are eligible and encouraged to apply for consideration for this program.

Naval Reserve and Marine Corps Reserve. The Secretary of the Navy may appoint 85 enlisted men of the Naval Reserve and Marine Corp Reserve each year. These men must be qualified as to age and must have served in the Reserve for at least 1 year by 1 July of the year of entrance to the Naval Academy. In addition to all other normal requirements for appointment, these men must be on active duty, or must be members of a drilling unit of the Reserve, be recommended by their commanding officers, and have maintained efficiency in drill attendance with their Reserve units.

Midshipmen USNR of the Regular NROTC Program and members of the Aviation Cadet Program are not eligible for appointment under this quota.

For further information about enlistment in the Naval Reserve or Marine Corps Reserve, applicants should apply to their nearest Navy or Marine Corps Recruiting Station.

Sons of Deceased Veterans. The President may have a maximum of 40 midshipmen, who are the sons of deceased veterans, attending the Naval Academy at any one time.

Eligibility for nomination under this quota is confined to sons of members of the Armed Forces of the United States who were killed in action or have died of wounds or injuries received, or disease contracted, or preexisting injury or disease aggravated, in active service during (1) World War I or World War II (as each is defined by law in providing service-connected compensation or pension benefits for veterans of World War I or World War II and their dependents); or (2) the Korean conflict beginning 27 June 1950 and ending 31 January 1955. The determination in each case of the Veterans' Administration as to the service connection of the cause of death is binding upon the Secretary of the Navy. A sample letter of application is included on page 21.

Honor Naval and Military Schools. The Secretary of the Navy may appoint annually 10 honor graduates of educational institutions designated as "honor schools" by the Department of the Army, Navy, and Air Force. Each such school may nominate three honor graduates to compete for the appointments. Included in the three may be students who are expected to be honor graduates in June of the year in which the examinations will be held. However, these nominees will not be considered for appointment unless they subsequently fulfill the requirements enabling them to be honor graduates at the time of their graduation. Eligible students should apply to the heads of their schools for nomination.

Naval Reserve Officers' Training Corps (Contract students only). The Secretary of the Navy may appoint 10 midshipmen annually from among members of the Naval Reserve Officers' Training Corps. Three candidates may be nominated each year by the president of each ed-

ucational institution in which an NROTC unit is established. Each candidate must be a regularly enrolled contract student in the NROTC and must have completed 1 year of scholastic work in the Corps at the time of entrance to the Naval Academy. Students should request a nomination from their professor of naval science.

Sons of Medal of Honor Winners. The sons of persons awarded the Medal of Honor may be appointed, provided they are in all other respects qualified. No recommendation or endorsement from any source is required. Applications for these appointments should be addressed to the Chief of Naval Personnel, Navy Department, Washington, D.C., 20370.

Qualified Alternates and Competitors

General. The Secretary of the Navy is authorized to appoint 150 qualified congressional alternates. These appointments are awarded to the best qualified alternates as recommended by the Academic Board of the Naval Academy.

Additional appointments from qualified alternates and competitors may be made by the Secretary to bring the Brigade of Midshipmen to its authorized strength. If these additional appointments are necessary, at least 75 percent must be selected from congressional nominees. The remainder may be made from noncongressional sources. The qualifications of all qualified alternate and competitive candidates will be carefully evaluated. No special application for these appointments by the individual is necessary or desired.

Foreign Students

Republic of the Philippines. On behalf of the President of the United States, the Secretary of the Navy is authorized to permit up to four Filipinos at a time to receive instruction at the Naval Academy. Applications for these appointments must be addressed through diplomatic channels. The appointments are on a competitive basis.

American Republics other than the United States. Upon designation by the President of the United States, the Secretary of the Navy is authorized to permit up to 20 persons at a time from foreign American Republics to receive instruction at the U.S. Naval Academy. Not more than three persons from any one Republic may receive instruction at the same time. Applications for these appointments must be addressed through appropriate diplomatic channels. The appointments are on a competitive basis.

Nominating Methods

Congressional. Members of Congress may nominate by either of the following methods:

- **Principal-Alternate Method**

The Congressman may nominate one principal candidate and five alternate candidates listed in order of his preference. If the

principal candidate meets the eligibility criteria and qualifies on the entrance examinations, he will be offered the appointment. If he does not, the next designated alternate candidate who qualifies will be chosen.

- **Competitive Method**

In evaluating candidates for the Congressman, the Academy analyzes the "whole man," assigning appropriate weighted values to several factors, including examination scores, previous academic work, extracurricular activity, participation in sports, the holding of class office, and the recommendations of principals and teachers. The candidate with the best composite score is offered the appointment.

Other Categories. The choice between the Principal-Alternate and Competitive Methods is also available to the District Commissioners and the Governors of Puerto Rico and the Canal Zone. The Governors of the Virgin Islands, Guam, and American Samoa must nominate by the Competitive Method in selecting the nominee for their one common appointment.

Candidates are selected for appointment on a strictly competitive basis from nominees entered in the several service-connected categories: Presidential, Sons of Deceased Veterans, Regular and Reserve Components, Honor Military and Naval Schools, and NROTC. Factors considered in the competition are the same as those discussed in the Competitive Method "whole man" analysis used for the evaluation of congressional candidates. There is no limit on the number of eligible candidates who may compete in the Presidential, Sons of Deceased Veterans, or Regular and Reserve categories.

Nominating Schedule. A candidate is advised to apply early for nomination. If seeking a congressional nomination, it is particularly important to apply early, *preferably during the spring of the junior year in high school.* Senators and Representatives may submit the names of their nominees any time between 1 July 1965 and 31 January 1966 for the class entering in June 1966. A majority of them will make their selections for nomination early in this period. It is, of course, too late to apply once the Congressman has selected his quota of nominees.

In any case, all nominations from all sources must be received by 31 January 1966 for the class entering in June 1966.

Civil Service Commission Examinations for Congressional Nominations. Some Congressmen and other authorized nominators utilize competitive examinations of the U.S. Civil Service Commission to assist them in evaluating and selecting their candidates. These special competitive examinations do not determine the candidate's scholastic qualifications for admission to the Naval Academy. The Naval Academy requirements must still be met fully.

Requesting a Congressional Nomination

Date _____

Honorable _____
House of Representatives
Washington, D.C. 20025

OR

Honorable _____
United States Senate
Washington, D.C. 20025

Dear Mr. _____:

Dear Senator _____:

It is my desire to attend the United States Naval Academy and to make the United States Navy my career. I respectfully request that I be considered as one of your nominees for the class that enters the Academy in June 1966.

The following personal data are furnished for your information :

Name: (As recorded on birth certificate)

Address: (City, County, State)

Name of Parents:

Date of Birth:

High School Attended:

Date of High School Graduation:

Approximate Grade Average:

My high school transcript of work completed to date is attached.

I have been active in high school extracurricular activities shown on the attached list.

I shall greatly appreciate your consideration of my request for a nomination to the U.S. Naval Academy.

Sincerely yours,
Signature

Requesting a Presidential Nomination

Date

Chief of Naval Personnel
Department of the Navy
Washington, D.C. 20370

ATTN: Pers-B66

Dear Sir:

I request a nomination under the Presidential category for the class that enters the Naval Academy in June 1966 and submit the following information:

Name: (Give name as shown on birth certificate. If different from that which you use, attach a copy of court order, if applicable.)

Address: (Give permanent and temporary address)

Date of Birth: (Spell out month)

Date of High School Graduation:

If Member of Military: (List rank, serial number, component, branch of service, and organizational address)

If Previous Candidate: (List year)

Information on Parent

Name, Rank, Serial Number, Component and Branch of Service:

Organizational Address:

Retired or Deceased: (Give date and attach copy of retirement orders or casually report)

Officer Personnel: (Attach statement of service prepared by Personnel Officer specifying Regular or Reserve status for all periods of service)

Enlisted Personnel: (Attach statement prepared by Personnel Officer listing date of enlistment, date of expiration of enlistment, component and branch of service)

Sincerely yours,
Signature

Requesting a Son of Deceased Veteran Nomination

Date

Chief of Naval Personnel
Department of the Navy
Washington, D.C. 20370

Attn: Pers-B66

Dear Sir:

I request a nomination under the Sons of Deceased Veterans category for the class that enters the Naval Academy in June 1966 and submit the following information:

Name: (Give name as shown on birth certificate. If different from that which you use, attach a copy of court order, if applicable.)

Address: (Give permanent and temporary address)

Date of Birth: (Spell out month)

Date of High School Graduation:

If Member of Military: (List rank, serial number, component, branch of service, and organizational address)

If Previous Candidate: (List year)

Information on Parent

Name, Rank, Serial Number, Regular or Reserve Component and Branch of Service:

Date and Place of Death:

Cause of Death:

Veterans Administration XC Claim Number: (Forwarding a copy of death certificate, preferably the casualty report, will expedite processing of your application)

Address of VA Office where case is filed:

Sincerely yours,
Signature

Scholastic Requirements

A candidate's previous academic record and his performance on specified College Entrance Examination Board Tests are the factors used to determine scholastic qualification for admission. The results of any College Board Test taken to qualify for the Naval Academy are applicable to all nominations which a candidate may hold.

There are two methods of qualifying scholastically for admission to the Naval Academy: the Examination Method and the College Certificate Method. These two methods are described on succeeding pages.

Submission of Scholastic Records

Each candidate is responsible for insuring the submission of detailed records of his completed high school, preparatory school, and college work and lists of any current or proposed courses. The official college transcript should be used for submitting college records.

Official forms for submitting high school records will be provided by the Navy Department following receipt of the nomination from the Member of Congress or other authorized appointment source. These certificates should be filled out and submitted to the Naval Academy by the school or schools as soon as practicable after receipt. It is important to each candidate that records be supplied promptly and that previous school records include academic marks, class standing or estimated class standing through the first semester of the final year. In the event that class standing for the end of the junior year is the latest available, it will be acceptable. Recommendations from the candidate's high school principal, teachers, extracurricular advisers, and coaches should be furnished on the forms provided. These records and recommendations will be considered in conjunction with the test results in order to establish the priority of qualified candidates in the various competitive lists and for the purpose of selection under the qualified alternate law. They must be received not later than 15 March.

It must be appreciated that, except for qualified congressional principals and qualified sons of Medal of Honor holders (who receive outright appointments), all candidates who have succeeded in qualifying scholastically, medically, and physically must be evaluated and arranged in order of precedence. The method utilized by the Academy to determine the relative merit of these qualified candidates is the identical "whole man" analytical process described previously under the Competitive Method on page 5.

Once candidates have been fully evaluated and assigned an appropriate numerical selection score, and their names placed on a master list in order of their scores, their relative positions on the list do not change. Thus the single master list serves to determine a candidate's relative position on any competitive list for which he is eligible.

Acceptable Scholastic Record. Each candidate must present an acceptable secondary school certificate from an accredited secondary school, or its equivalent, including at least 15 units of credit in college preparatory subjects and indicating ability to do college-level work successfully. While not an absolute requirement, standing in the top 40 percent of one's high school class is of great importance in determining qualification for admission. (The great majority of midshipmen come from the top 20 percent of their high school classes.) Candidates should, insofar as is practicable, include as many as possible of the following studies in their secondary school programs:

- At least 3 years but preferably 4 years of mathematics, including the elements of advanced algebra, geometry, and trigonometry.
- Four years of English.
- Two years of a foreign language, preferably modern.
- One year of chemistry.
- One year of physics.

It is expected that the secondary school official will recommend only those candidates who, in his opinion, have excellent character and the scholastic background needed to pursue a difficult course of college level in which the emphasis is placed on engineering subjects as well as the humanities.

Deficiencies in the secondary school certificate can often be offset by offering acceptable college work. Conversely, evidence of inability to do acceptable college work can be cause for disqualification.

Examination Method. The basic method of qualifying is by presenting an acceptable secondary school certificate and by scoring acceptably in the scholastic entrance examination consisting of the 4 December 1965, 8 January or 5 March 1966 administrations of the following tests of the College Entrance Board: The Scholastic Aptitude Test (Verbal and Mathematics sections), the English Composition Test, and either the Level I (Standard) or Level II (Intensive) Mathematics Achievement Test. The Level II Test is offered on 8 January only. It is the candidate's responsibility to insure that he takes these required tests. No substitutes will be considered in qualifying for entrance to the U.S. Naval Academy.

Tests must be taken during the school year preceding admission. Candidates are encouraged to choose the mathematics achievement test on which they feel they can attain the higher score. Level I is recommended for candidates without advanced high school mathematics. No additional weight is given to the results of the test in Level II Mathematics over those in Level I Mathematics.

Basic qualifying scores in the College Entrance Examination Board Tests for any class will be determined by the Academic Board of the Naval Academy. No candidate will be admitted to the Naval Academy unless in the opinion of the Academic Board he shows the requisite scholastic qualifications.

nical institution of college grade during which the candidate completed courses totaling at least 24 semester hours of credit for subjects acceptable to the Naval Academy with grades substantially better than the college minimum passing grade. Six semester hours must be in pure mathematics, such as college algebra, trigonometry, analytical geometry, calculus, etc., and 6 semester hours must be in English or history, or a combination thereof. The remaining credits necessary to complete the certificate may be offered from a wide range of college liberal arts or engineering subjects. The overall quality of the college record must be acceptable to the Naval Academy.

The length of college attendance prescribed is defined as requiring actual full-time attendance for one regular school year during which the candidate pursues courses constituting a normal year's load.

A candidate who contemplates qualifying by the College Certificate Method but who has not completed the required year of college at the time of receipt of his nomination should have his high school record and a preliminary college record submitted showing the courses contemplated or in progress and the amount of credit in semester hours to be assigned for each course. A form for submitting the high school record will be provided by the Navy Department. The official transcript form of the college should be used for submitting the college record. An early review of the record of completed work and of courses proposed for completion may reveal defects which can be corrected by slight changes in the final semester schedule. The certificate action reports issued by the Naval Academy indicate steps which the candidate should take. However, if in doubt, a candidate should address a letter to the Dean of Admissions, U.S. Naval Academy, Annapolis, Md.

Qualifying in Previous Year. Former midshipmen who have successfully completed the first year of the Naval Academy's course need not requalify scholastically for admission, but they must demonstrate to the satisfaction of the Academic Board that they are qualified for readmission. All other former candidates must requalify scholastically and medically for the class to which they seek admission.

Medical Qualification

The Chief of Naval Personnel, Navy Department, Washington, D.C., 20370, will send to each duly nominated candidate an authorization designating the time and place of medical examination. Medical examinations are conducted at some 70 Navy examining centers and at specified examining centers of the Army and Air Force, located throughout the United States. Starting this year, one standardized medical examination is being given at all designated examining centers. (See listing of these centers at end of this section.)

Examinations are conducted starting on 1 July of the year preceding the year of admission. A final decision on the medical eligibility of

each candidate must be reached by 15 March the year of entry.

Candidates are required to be physically fit, well formed, and of sound constitution. The medical requirements are exacting, thus protecting the best interests of the Government, the Navy, and the individual.

All candidates are encouraged to undergo thorough medical and dental examinations by a private physician using the Medical Examination Considerations set forth herein as a guide in determining their medical and dental condition before pursuing nomination and before taking the qualifying medical examination. This will serve to identify obviously disqualified applicants or those who may have remediable defects which must be corrected at the candidates' expense. The candidates who are obviously disqualified will benefit themselves and the U.S. Government by not pursuing candidacies further. All candidates are advised to carry sun glasses for use after the eye examination.

Specific information concerning medical and physical requirements follows.

Medical and Physical Aptitude Examinations

The Naval Academy Qualifying Medical Examination determines a candidate's medical status for admission to the Academy. Members of Congress may authorize a Naval Academy Medical Examination for an applicant at the authorized medical examining facilities to determine his medical qualification. This examination will be considered a final Naval Academy Qualifying Medical Examination. Thus, it will not be necessary for a formally nominated candidate to return to a medical examining facility for further medical examination. Candidates who have a Qualifying Medical Examination on file taken since 1 July 1965 will be required to take only the Physical Aptitude Examination. Formally nominated candidates to the Naval Academy are required to satisfactorily complete a Physical Aptitude Examination which is in conjunction with the Qualifying Medical Examination. This examination includes a series of exercises designed to determine coordination, strength and endurance of the body musculature. Included are sit-ups, pull-ups, arm hang, and a squat walk exercise. It also includes a battery of tests which will bring out disqualifying orthopedic defects such as shoulder, knee, or other malfunctions. Failure to pass any part of this examination will be cause for rejection.

When reporting for Medical and Physical Aptitude Examination, candidates are required to have suitable shorts and supporter for use when undergoing the Physical Aptitude Examination.

Candidates who are ordered to report for Medical and Physical Aptitude Examination and who are unable to take the Physical Aptitude Examination at that time will be required to produce substantiating medical evidence. Insufficient evidence will be cause for their disqualification. Formally nominated candidates who are injured

or ill for any reason and unable to comply with instructions to report for Medical and Physical Aptitude Examination are required to communicate with the Chief of Naval Personnel and the scheduled examining facilities to explain the circumstances of the injury or illness before further examination or delay in examination will be authorized. Candidates who have undergone major surgery involving knee, ankle, shoulder, elbow, wrist or spine will *Not* be scheduled for examination until six months have elapsed following surgery. Medical and Physical Aptitude Examinations will terminate on 15 March 1966. Injury and surgical cases will not be considered after this date. Candidates having orthodontic appliances in place will be required to have them removed prior to reporting for Qualifying Medical Examination.

While candidates may be scheduled for Medical and Physical Aptitude Examinations at Army, Navy and Air Force facilities, the major portion of Naval Academy candidates will be scheduled for examination at naval medical examining facilities. Candidates examined at naval medical examining facilities will normally be required to spend one day under examination. Candidates are to report prior to 0730 on the day of examination except as otherwise directed in reporting orders. Candidates ordered to Army and Air Force examining centers will be required to spend at least two days to complete examinations.

Candidates are required to pay their own transportation, berthing and necessary expenses in connection with these examinations. *Only one Medical and Physical Aptitude Examination will be authorized for any candidate. Reexamination will not be authorized except as required by the Chief of Naval Personnel.*

Review and Waiver Procedure

The results of all medical examinations of candidates for the Naval Academy are subject to review by the Permanent Board of Medical Examiners, U.S. Naval Academy. Medical qualification decisions made by that Board are final. In this respect, where the disqualifying defect is subject to medical or dental correction, the candidate may be conditionally rejected subject to later certification by a registered physician or dentist that the defect has been corrected with complete restoration of function. It is mandatory that such certification reach the Permanent Board of Medical Examiners as soon as possible and not later than 15 March in any case. Final reports of applicants certified by that Board will be distributed to Chief of Naval Personnel, Chief, Bureau of Medicine and Surgery, and the Academic Board, U.S. Naval Academy. *The Academic Board may grant waiver of a very minor defect to a candidate who is outstanding in all other respects.*

Since waiver action is predicated upon the overall quality of a candidate's record, it is important that transcripts of secondary school or college work, the report of extracurricular activities, and the required

letters of recommendation be submitted as soon as possible. In some instances it will be necessary to delay evaluation of a record until results of the March College Board tests have been received. *It is emphasized that review and waiver procedures are automatic for all candidates who were found not medically qualified upon formal Qualifying Medical Examination and that queries regarding the status of waiver action will only delay final determination.* Notification of Medical and Physical Aptitude Disqualification will be made to all candidates by the Chief of Naval Personnel. Requests for reexamination of those candidates who fail the medical examination can be approved only by the Chief of Naval Personnel and only under extremely extenuating circumstances.

Special Medical Examination Considerations

The following special medical examination considerations are listed in order that candidates, prospective candidates, and their private physicians and dentists may have the basic medical requirements for entrance to the Academy readily available.

Medical History: The medical history will be compiled with particular care with elaboration where indicated. Inquiries will be made in detail concerning all illnesses, injuries, and operations which the candidates may have incurred. Failure to fully document these items results in disappointment when medical disqualification is determined later. A history of familial diseases will be investigated with thoroughness. If the candidate has received medical care which significantly affects his physical status he will be required, whenever practicable, to submit evidence from attending physicians or from hospital records concerning this medical care. *A candidate who has defects which are remediable, including dental defects, should have them corrected prior to taking the Naval Academy Qualifying Medical Examination.*

Weight Standards:

Height (inches)*	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Weight (pounds):															
Minimum	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168
Maximum	160	165	170	175	181	186	192	197	203	209	214	219	225	230	235

*Waiver for height up to 80 inches may be granted to a limited number of candidates with exceptional scholastic and leadership achievements.

These weight standards are necessarily arbitrary. Waiver may be granted in unusual cases under circumstances as follows: When a generally large bony structure and large well-distributed and proportioned muscle masses with little evidence of thick layers of subcutaneous fat account for the apparent excessive weight, exception to the standards may be granted by the Permanent Board of Medical Examiners at the Naval Academy or recommendation may be made by the Board of Medical Examiners to the Academic Board at the Naval Academy for

waiver. Likewise, when weight is under the prescribed standards, if the skeletal structure is relatively slight but muscle development and strength is excellent, as manifested by demonstrable performance of physical aptitude tests and history of athletic participation, similar action may be taken.

Eyes and Vision: A cycloplegic refraction is required on all prospective nominees and candidates. Unaided visual acuity of 20/20 is required. In all cases the actual vision of each eye and the correction lens, if required, must be reported. Any tropia is disqualifying. Both eyes must be free from any disfiguring or incapacitating abnormality and from acute or chronic disease. Candidates wearing contact lenses will remove them at least 36 hours prior to reporting for medical examination. Normal color perception is required. Results of color tests will reflect the name of the test, the number of plates correctly read, and the number of plates in the test; i.e., 14/17. Use of Farnsworth Lantern is required where available. (Waivers for visual acuity up to 20/40, correctable to 20/20, may be granted to a limited number of candidates with exceptional scholastic and leadership achievements.)

Ears and Hearing: Auditory acuity of all candidates will be determined by audiometer if available. Whispered voice at 15 feet right and left ear is acceptable if audiometric equipment is not available.

Frequency	500 512	1000 1024	2000 2048	3000 2896	4000 4096	8000 8192
Maximum loss: in decibels						
Better ear.....	15	15	15	35	(1)	(1)
Worse ear.....	15	15	15	35	(1)	(1)

¹ Record for baseline information only.

Both ears must be free from any disfiguring or incapacitating abnormality and from acute or chronic disease.

Nares: Septal deviation, hypertrophic rhinitis, or other conditions which result in 50 percent or more obstruction of either airway, or which interfere with drainage of a sinus on either side, are causes for rejection.

Skin: Chronic skin diseases such as severe acne or eczema or unsightly congenital markings are cause for disqualification. Pilonidal sinus if evidenced by presence of mass or discharging sinus is cause for rejection.

Heart and Vascular System: An electrocardiogram is required of all candidates. The following conditions are either not acceptable or require extensive medical workup: all organic vascular diseases of the heart, including those improved by surgery; EKG evidence of variations from normal heart beat; hypertension evidenced by predominant blood pressure reading of 140 mm or more systolic or 90 mm or more diastolic; varicose veins if severe or symptomatic; heart rate greater

than 100 on repeated examinations; substantiated history of rheumatic fever within the previous 2 years, recurrent attacks of rheumatic fever or evidence of residual cardiac damage; history of recurring rapid heart beat within the preceding 5 years.

Serologic Tests: A serologic test for syphilis is performed on all candidates. An authentic history of syphilis of any type is cause for rejection without further laboratory procedure.

Genitourinary System: Persistent albuminuria of any type or the persistence of casts in the urine will be cause for rejection, even though the etiology cannot be determined. Other causes for rejection: phimosis; epispadias or pronounced hypospadias; atrophy, deformity, or maldevelopment of both testicles; or undescended testicles of any degree. Bed wetting persisting into late childhood or early adolescence is cause for rejection.

Neurological Examination: A history of motion sickness (i.e., air, sea, swing, train, or carnival ride) should be thoroughly investigated. A history of head injury resulting in unconsciousness must be completely evaluated and an electroencephalogram is required. Investigate for degenerative disorders; these are not acceptable. Neither is established migraine.

Asthma: Asthma by diagnosis or history since age 12 is cause for rejection.

Abdominal Wall Examination: If physical findings include hernia of any type, candidate is disqualified until corrected; history of operation for hernia within past 60 days is disqualifying. Other abnormal diseases and conditions which are not acceptable include stomach or small bowel ulcer or history of same; acute or chronic gall bladder disease; history of removal of the spleen for reason other than trauma.

Miscellaneous medical findings of significance that are not acceptable unless remedied: Deviated nasal septum resulting in greater than 50 percent obstruction to either airway or obstruction to the drainage of any sinus; obesity, even though the candidate's weight is within the maximum shown in the height-weight table; and acute communicable diseases, until recovery.

Miscellaneous medical findings that are disqualifying: Anemia; abnormal bleeding states; diabetes mellitus or history of diabetes in both parents; persistent sugar in urine regardless of cause; ununited fractures; history of surgery to a major joint within past 6 months; history of derangement of knee joint not corrected by surgery, or evidence of instability subsequent to surgery; total loss of either thumb; tuberculosis, active in past 5 years; hay fever, if severe, or having undergone desensitization therapy during past 3 years prior to examination; nasal polyps; personality disorders; symptomatic immaturity disorders such as stammering or stuttering; arthritis; and herniated nucleus pulposus or history of operation for this condition.

Dental Standards: A candidate for appointment must have a minimum of 16 natural permanent teeth, of which a minimum of 8 must be in each arch. All missing teeth causing unsightly spaces or significantly reducing masticatory or incisal efficiency must be replaced by well-designed bridges or partial dentures which are in good condition. Except for minor or questionable carious areas, all required dental treatment *must* be completed. Disqualifying defects are as follows:

- Lack of satisfactory incisal or masticatory function.
- Failure to have a minimum of 8 natural permanent teeth in each arch.
- Edentulous spaces which are unsightly or which significantly reduce masticatory function.
- Carious teeth, except minor or questionable carious areas.
- Infectious or chronic diseases of the soft tissue of the oral cavity.
- Marked malocclusion resulting in severe dentofacial deformity.
- Orthodontic appliances attached to teeth for continued orthodontic treatment (retainer appliances are permissible).
- Unsatisfactory restorations, bridges, or dentures.
- Severe or extensive apical or periodontal infection.
- Perforations from the oral cavity into the nasal cavity or maxillary sinus.
- Tumors or cysts of the oral tissues which require treatment or may require treatment in the foreseeable future.

Authorized Medical Examining Facilities for Naval Academy Medical Examinations

ALABAMA

Brookley AFB, Mobile
Fort Rucker, Daleville
Maxwell AFB, Montgomery

Fort Huachuca, Cochise County
Williams AFB, Chandler

ALASKA

Elmendorf AFB, Anchorage
Fort Richardson, Anchorage
USNAS, Adak
USNAS, Kodiak

ARKANSAS

Blytheville AFB, Blytheville
Little Rock AFB, Jacksonville

ARIZONA

Davis-Monthan AFB, Tucson

CALIFORNIA

Beale AFB, Marysville
Castle AFB, Merced
Edwards AFB, Edwards
Fort MacArthur, San Pedro
Fort Ord, Monterey
George AFB, Victorville
Hamilton AFB, Ignacio
Letterman Gen Hosp, San Francisco
March AFB, Riverside
Mather AFB, Sacramento
McClellan AFB, Sacramento
Norton AFB, San Bernardino
Travis AFB, Fairfield

Vandenberg AFB, Lompoc
USNAS, Alameda
USN Hosp, Camp Pendleton
USN Air Facility, El Centro
USN Aux Air Stn, Ream Fld,
Imperial Beach
USNAS, Lemoore
USN Hosp, USS Haven,
Long Beach
USNAS, Los Alamitos, Long Beach
USNAS, Moffett Field
USN Air Facility, Monterey
USN Hosp, Oakland
USN Missile Ctr, Point Mugu
USMCAS, El Toro, Santa Ana
USN Hosp, San Diego
NAS, North Island, San Diego
USNAS, Miramar, San Diego

COLORADO

Fitzsimons Gen Hosp, Denver
Lowry AFB, Denver
USAF Academy

DELAWARE

Dover AFB, Dover

DISTRICT OF COLUMBIA

Andrews AFB
USN Air Facility, Andrews AFB
Walter Reed Gen Hosp

FLORIDA

Eglin AFB, Valparaiso
Homestead AFB, Homestead
MacDill AFB, Tampa
Tyndall AFB, Panama City
USNAS, Cecil Field
USN Hosp, Jacksonville
USNAS, Jacksonville
USN Hosp, Key West
USNAS, Key West
USN Hosp, Pensacola
USNAS, Pensacola
USNAS, Sanford
USNAS, Whiting Field

GEORGIA

Fort Benning, Columbus
Fort Gordon, Groveton
Fort McPherson, Atlanta
Fort Stewart, Hinesville
Hunter AFB, Savannah
Moody AFB, Valdosta
Robins AFB, Warner Robins
Turner AFB, Albany

USNAS, Atlanta
USNAS, Glynco

HAWAII

Hickam AFB, Honolulu
Tripler Gen Hosp, Honolulu

IDAHO

Mountain Home AFB,
Mountain Home

ILLINOIS

Chanute AFB, Rantoul
Fort Sheridan, Highland Park
Scott AFB, Belleville
USN Hosp, Great Lakes
USNAS, Glenview

INDIANA

Bunker Hill AFB, Peru
Fort Benjamin Harrison,
Indianapolis

KANSAS

Forbes AFB, Topeka
Fort Leavenworth, Leavenworth
Fort Riley, Junction City
McConnell AFB, Wichita
USNAS, Olathe

KENTUCKY

Fort Knox, Hardin County

LOUISIANA

Barksdale AFB, Shreveport
England AFB, Alexandria
USNAS, New Orleans

MAINE

Dow AFB, Bangor
Loring AFB, Limestone
USNAS, Brunswick

MARYLAND

Fort George G. Meade, Odenton
USN Hosp, Bethesda
USN Training Center, Bainbridge
US Naval Academy, Annapolis
USNAS, Patuxent

MASSACHUSETTS

Boston Army Base, Boston
Fort Devens, Ayer
Otis AFB, Falmouth
USN Hosp, Chelsea

USNAS, South Weymouth
Westover AFB, Chicopee Falls

MICHIGAN

Kincheloe AFB, Kincross
K. I. Sawyer AFB, Gwinn
Selfridge AFB, Mt. Clemens
USNAS, Grosse Ile
Wurtsmith AFB, Oscoda

MINNESOTA

USNAS, Minneapolis

MISSISSIPPI

Columbus AFB, Columbus
Keesler AFB, Biloxi
USN Aux Air Stn, Meridian

MISSOURI

Fort Leonard Wood, Waynesville
Richards-Gebaur AFB, Grandview
Whiteman AFB, Knob Noster

MONTANA

Glasgow AFB, Glasgow
Malmstrom AFB, Great Falls

NEBRASKA

Lincoln AFB, Lincoln
Offutt AFB, Omaha

NEVADA

Nellis AFB, Las Vegas
Stead AFB, Reno

NEW HAMPSHIRE

Pease AFB, Portsmouth
USN Hosp, Portsmouth

NEW JERSEY

Fort Dix, Wrightstown
Fort Monmouth, Oceanport
McGuire AFB, Wrightstown
USNS, Lakehurst

NEW MEXICO

Cannon AFB, Clovis
Holloman AFB, Alamogordo
Kirtland AFB, Albuquerque
Walker AFB, Roswell

NEW YORK

Griffiss AFB, Rome

Plattsburgh AFB, Plattsburgh
Stewart AFB, Newburgh
Suffolk County AFB,
Westhampton Beach, L.I.
US Military Academy, West Point
USNAS, New York
USN Hosp, St. Albans, Long Island

NORTH CAROLINA

Fort Bragg, Fayetteville
Seymour Johnson AFB, Goldsboro
USN Hosp, Camp Lejune
USMCAS, Cherry Point
USMC Air Facility, New River

NORTH DAKOTA

Grand Forks AFB, Meckinock
Minot AFB, Minot

OHIO

Lockbourne AFB, Columbus
Wright-Patterson AFB, Dayton

OKLAHOMA

Altus AFB, Altus
Clinton-Sherman AFB, Burns Flat
Fort Sill, Lawton
Tinker AFB, Oklahoma City

OREGON

Portland International
Airport, Portland

PENNSYLVANIA

Carlisle Barracks, Carlisle
Olmsted AFB, Middletown
USN Air Facility, Johnsville
USN Hosp, Philadelphia
USNAS, Willow Grove
Valley Forge Gen Hosp,
Phoenixville

RHODE ISLAND

USN Hosp, Newport
USN Stn, Newport
USNAS, Quonset Point

SOUTH CAROLINA

Charleston AFB, Charleston
Fort Jackson, Columbia
Shaw AFB, Sumter
USN Hosp, Beaufort
USMCAS, Beaufort
USN Hosp, Charlestown

SOUTH DAKOTA

Ellsworth AFB, Rapid City

TENNESSEE

Fort Campbell, Clarkesville
Sewart AFB, Smyrna
USN Hosp, Memphis
USNAS, Memphis

TEXAS

Amarillo AFB, Amarillo
Bergstrom AFB, Austin
Biggs AFB, El Paso
Carswell AFB, Fort Worth
Dyess AFB, Abilene
Fort Hood, Killeen
Fort Sam Houston, San Antonio
James Connally AFB, Waco
Lackland AFB, San Antonio
Laredo AFB, Laredo
Laughlin AFB, Del Rio
Perrin AFB, Sherman
Randolph AFB, San Antonio
Reese AFB, Lubbock
Sheppard AFB, Wichita Falls
USN Aux Air Stn, Beeville
USN Hosp, Corpus Christi
USNAS, Corpus Christi
USNAS, Dallas
USNAS, Kingsville
Webb AFB, Big Spring
William Beaumont Gen Hosp,
El Paso

UTAH

Hill AFB, Ogden

VIRGINIA

Langley AFB, Hampton
Fort Belvoir, Fairfax County
Fort Eustis, Lee Hall
Fort Lee, Petersburg
Fort Monroe, Old Point Comfort
USNAS, Norfolk
USN Hosp, Portsmouth
USN Hosp, Quantico
USMCAS, Quantico
USNAS, Virginia Beach

WASHINGTON

Fairchild AFB, Spokane
Fort Lewis, Tacoma
Larson AFB, Moses Lake
McChord AFB, Tacoma
USN Hosp, Bremerton
USNAS, Oak Harbor
USNAS, Seattle

WISCONSIN

Truax Field, Madison

WYOMING

Francis E. Warren AFB, Cheyenne

CANAL ZONE

Albrook AFB, Balboa
Fort Clayton
USN Stn, Rodman

CUBA

USN Hosp, Guantanamo Bay

ENGLAND

S. Ruislip Air Stn, Middlesex
USN Support Activity, London

FRANCE

Evreux AB

GERMANY

US Army Hosp, Heidelberg
Wiesbaden AB, Wiesbaden

GUAM

USN Hosp

ITALY

USN Support Activity, Naples

JAPAN

Camp Zama
Tachikawa AB, Honshu
USN Hosp, Yokuska

NEWFOUNDLAND

Ernest Harmon AFB, Stephenville
USN Stn, Argentia

PHILIPPINE ISLANDS

Clark AB, Luzon
USN Stn, Subic Bay

PUERTO RICO

Ramey AFB, Aguadilla
USNAS, Roosevelt Rds

SPAIN

Torrejon AB
USNAS, Rota



Entrance Information and Procedures

Candidates for whom there are vacancies, who have subscribed to the "Engagement to Serve" and who have met the scholastic, moral, and physical requirements will receive appointments as midshipmen and be admitted to the Naval Academy.

- In keeping with the policy of the Department of Defense and as directed by the Secretary of the Navy, candidates for appointment as midshipmen are required to execute a loyalty certificate. The purpose of this certificate is to aid in determining whether the candidate's conduct or associations, past or present, have been such as to cast any doubt whatever upon his loyalty to the Government of the United States.

The loyalty certificate includes a list of those agencies, groups, etc., designated by the Attorney General of the United States to be totalitarian, fascist, communist or subversive, or as having adopted a policy of advocating or approving the commission of acts of force or violence to deny persons their rights under the Constitution of the United States.

The admission of conduct or association, past or present, within the purview of acts as defined in the certificate, or association with any of the groups or organizations designated by the Attorney General, shall



preclude appointment pending investigation and determination of eligibility by the Department of the Navy.

False representation, or failure fully to disclose conduct or associations defined in the certificate shall constitute grounds for trial before a general court-martial with possible consequent conviction and imprisonment, or for separation from the naval service under conditions other than honorable, with or without any preceding court-martial procedure.

- Each candidate for midshipman will be required to take the following oath of office upon entrance:

"I, _____, of the State of _____ aged _____ years _____ months, having been appointed a midshipman in the United States Navy, do solemnly swear (or affirm) that I will support and defend the Constitution of the United States against all enemies, foreign and domestic; that I will bear true faith and allegiance to the same; that I take this obligation freely, without any mental reservation or purpose of evasion; and that I will well and faithfully discharge the duties of the office on which I am about to enter; So Help Me God."

- He will also be required to subscribe to the following under oath :

"For and in consideration of the privileges, opportunities, and benefits afforded me during the continuance of my service as a midshipman, I agree to and with the Superintendent of the United States Naval Academy, as follows:

"First: To enter the service of the Navy of the United States and to the utmost of my power and ability to be in everything conformable and obedient to the several requirements and lawful commands of the officers who may be placed over me.

"Second: I oblige myself, during such service, to comply with and be subject to the Uniform Code of Military Justice and such other laws and regulations as are or shall be established by the Congress of the United States or other competent authority.

"Third: To submit to treatment for the prevention of smallpox, typhoid (typhoid prophylaxis), and to such other preventive measures as may be considered necessary by naval authorities."

- Candidates are usually sworn in as midshipmen on the day they are accepted for admission, i.e., the date of reporting at the Naval Academy as designated in the authorization to report issued by the Bureau of Naval Personnel. Due to limited living accommodations in the city of Annapolis, candidates are urged to time their arrival at Annapolis to coincide as closely as possible with the reporting date, keeping in mind, however, that transportation facilities between Washington and Baltimore and Annapolis are not unlimited. Those arriving in Annapolis a day or two prior to their reporting date may take advantage of berthing and messing facilities usually made available in the Naval Academy at a cost of \$1 per night. Additionally, candidates may take their meals in the Midshipmen's Mess at a cost equal to the cost of a midshipman's daily ration allowance.

- *Before being admitted as a midshipman, each candidate must deposit with the midshipmen's storekeeper the sum of \$300, to be used in part payment to cover cost of uniforms, clothings, etc.* In cases of extreme hardship this sum may be reduced to \$100 in which case money allowances for the individual will be reduced until the individual account reaches prescribed levels. The amount deposited is not refunded, but is expended for entrance outfit, clothing, uniforms, etc., which become the property of the midshipman.

- The pay of the midshipman is \$1,447.20 a year, commencing at the date of his admission. Its purpose is to permit him to cover his expenses; i.e., uniforms, books, equipment, laundry, income tax, etc., while at the Naval Academy.

- The regulation entrance outfit, plus the additional uniforms, clothing, textbooks, and expenses required the first year, are valued at approximately \$1,600. The deposit made at the time of entrance is

supplemented by an entrance credit of \$600 upon first admission to the Naval Academy. The \$600 credit is an interest-free loan advanced by the Government to defray the cost of the uniforms and equipment required during the first year. Repayment of the indebtedness is accomplished by monthly deductions of \$20 from the midshipman's pay, beginning in October of the second year at the Naval Academy and continuing until the indebtedness is liquidated. Midshipmen who are involuntarily separated from the Naval Academy prior to repayment of the entrance credit, are required to turn in all articles of uniform and equipment deemed suitable for reissue, to an amount sufficient to liquidate the indebtedness. If reclaimed articles are insufficient to cover the indebtedness, parents will be given an opportunity to liquidate the remaining debt; failing this, the remainder of the debt is canceled. Midshipmen applying for voluntary separation for their own convenience are required to repay in full the amount of indebtedness prior to such separation.

- *Every candidate must present his Social Security card upon reporting for appointment.* If an individual has not obtained a social security number as a result of work experience prior to entering, he should obtain one based on the strength of expected employment as a midshipman.

- Shortly after entrance, each midshipman (except Foreign Nationals) will be required to complete a Statement of Personal History. Candidates should be prepared to furnish such information as:

Names and locations of all schools attended.

Family names, dates and places of birth of parents, service data if parents are or were in Armed Forces, naturalization numbers of parents if applicable.

Relatives in Foreign Countries—relationship and location.

Names and addresses of former employers.

Names and addresses of three credit and five personal references. (Credit references may be those of parents.)

Residences during past 15 years. (Dates, street addresses, cities, required.)

- Candidates admitted as midshipmen will be required to submit evidence of birth to the Superintendent, U.S. Naval Academy, for transmission to the Bureau of Naval Personnel upon admission, or as soon as practicable thereafter. A certified copy of the public record of birth is the best evidence. Supporting evidence will be required if the name on the evidence of birth is not identical with the name being used.

- Upon entrance, midshipmen will be required to obtain from the midshipmen's storekeeper a regulation entrance outfit. Slide rules and drawing sets are furnished as part of the outfit. Candidates are advised, therefore, not to purchase these items prior to entering the Academy.

- After being admitted to the Naval Academy, midshipmen receive travel and transportation allowances as prescribed in *Joint Travel Regulations* (ordinarily, mileage allowance of 6 cents per mile for authorized travel). This reimbursement will be paid to the midshipman. Reimbursement will be made for the actual cost of passage fares on commercial vessels if sea travel is involved and provided no Government transportation was available. In the event travel originates outside the United States, candidates must contact the nearest naval activity for information as to the availability of Government transportation before endeavoring to procure commercial transportation. When Government transportation is not available, a certified statement to this effect must be presented in order for the candidate to be reimbursed after he has become a midshipman.

- The course of instruction at the Naval Academy is of 4-years' duration and is designed for the purpose of educating and training students to become officers in the Navy. The word "officers" as used in the foregoing sentence means officers of the line and does not include officers of the Medical Corps, Dental Corps, etc. The curriculum provides a basic education in naval science; science and engineering; and the humanities and social sciences. In addition, there is opportunity for advanced work through validation of college-level courses successfully completed elsewhere, and through a program of elective courses. No midshipman can be admitted or readmitted to other than the fourth (freshman) class. Readmitted midshipmen who previously completed successfully one or more years of the Naval Academy course may request advancement to a higher class after reentry. There can be no deviation from the statutory age limits.

- Graduates of the Naval Academy, who meet all requirements, are commissioned as ensigns in the Navy or (a limited number) as second lieutenants in the Marine Corps. Their commissions may be revoked at any time during the first 3 years following graduation from the Naval Academy. On successful completion of the probationary period, officers are permanently commissioned. Officers whose commissions are revoked shall be discharged from the service, without advance pay or allowances.

Service Obligation for Enlisted and Other Candidates Appointed as Midshipmen

Enlisted members of the Armed Forces who accept appointments as midshipmen at the Naval Academy will not be discharged from

their enlistment contracts or from their period of obligated service while they are in the status of midshipmen except for physical disability or because of the acceptance of a commission. (Act of 25 June 1956, §§ 1-2, reenacted 10 U.S.C. 516.)

Midshipmen in this category who are separated from the Naval Academy, except for one of the two reasons given above, will have their appointments as midshipmen terminated and will immediately resume their enlisted status. Members so reverted will be required to serve out their enlistments or obligated service, unless sooner discharged. In computing the unexpired portion of an enlistment contract or period of obligated service, the time served as a midshipman shall be counted as time served under such contract or period of obligated service.

Candidates entering the Naval Academy from civil life who had not previously acquired a military obligation will automatically do so upon acceptance of appointment as midshipmen at the United States Naval Academy. Under certain of the provisions of the Universal Military Training and Service Acts, any person who is enlisted, inducted, or appointed in any of the Armed Services or Reserve Components acquires automatically a 6-year military obligation. Section IV. B. 3.f of Department of Defense Directive 1200.3 of 23 May 1958 includes appointees to the Service Academies among those who are subject to the 6-year obligation. Such candidates will be required to execute the following statement of understanding of this obligation prior to appointment as midshipmen:

"I understand that if my appointment as a midshipman is terminated other than for the purpose of accepting a commission, I shall if qualified be transferred to a ready reserve component of the United States Navy or the United States Marine Corps, in a grade deemed appropriate by the Secretary of the Navy. I fully understand the requirement for satisfactory participation in the Ready Reserve. I also understand that upon completion of a period of satisfactory Ready Reserve service which, when added to my service as a midshipman, totals 5 years, I shall if I request be transferred to the Standby Reserve to complete the total military service obligation of 6 years acquired under section 4(d) (3) of the Universal Military Training and Service Act as amended (50 U.S.C. App. 454(d) (3), 10 U.S.C. 651).

"I understand further that if, after termination of my appointment as a midshipman, I should complete my total 6-year military service obligation without serving the minimum period of active duty required for exemption I may be liable for induction under Selective Service regulations to complete the 2-year active duty obligation prescribed by section 4(b) of the Universal Military Training and Service Act as amended (50 U.S.C. App. 454 (b))."

Engagement To Serve (10 U.S.C. 6959)

Each midshipman who is a citizen or national of the United States shall sign an agreement that, unless sooner separated, he will:

- Complete the course of instruction at the Naval Academy
- Comply with such provisions of law as may be directed by the Secretary of the Navy for midshipmen who voluntarily disqualify themselves for the course
- Comply with such provisions of law as may be established for separated midshipmen
- Accept an appointment and serve as a commissioned officer of the Regular Navy or the Regular Marine Corps for at least 5 years immediately after graduation
- Accept an appointment as a commissioned officer in the reserve component of the Navy or the Marine Corps, and remain therein until the sixth anniversary of his graduation, if an appointment in the regular component of that armed force is not tendered to him, or if he is permitted to resign as a regular commissioned officer before the sixth anniversary.

If the midshipman is a minor and has parents or a guardian, he may sign the agreement only with the consent of the parents or guardian.

Officers of the Armed Services serve at the pleasure of the President. No terminal dates are established for their commissions.

Foreign Students

Persons receiving instruction under authority of this law shall receive the same pay, allowances, and emoluments, to be paid from the same appropriations, and, subject to such exceptions as may be determined by the Secretary of the Navy, shall be subject to the same rules and regulations governing admission, attendance, discipline, resignation, discharge, dismissal, and graduation, as midshipmen at the Naval Academy appointed from the United States; but such persons shall not be entitled to appointment to any office or position in the United States Navy by reason of their graduation from the Naval Academy. The entrance deposit will be required of all foreign students. Applications for appointment under provisions of this law must be addressed through diplomatic channels of the applicant's country. Nominations must reach the State Department in Washington, D.C., by 1 January 1966.

Each candidate must:

- Be an unmarried, bona fide male citizen of the nominating country and, unless otherwise approved by the Secretary of the Navy, be not less than 17 years of age nor more than 22 years of

age on 1 July of the calendar year in which he enters the Naval Academy.

- Possess medical qualifications as specified in this pamphlet. All candidates must undergo a medical examination and a physical aptitude examination by a board of medical examiners designated by the Chief of Naval Personnel. Qualifying medical and physical aptitude examination will be conducted by the Permanent Medical Examining Board at the United States Naval Academy at the time of reporting for admission. Such candidates are therefore urged to undergo careful preliminary examination by qualified medical personnel informed of the physical requirements set forth elsewhere in this pamphlet before leaving their homes for the Naval Academy. Those with obviously disqualifying defects may be spared the needless expense of the trip to Annapolis. However, in case of reasonable doubt as to whether defects are disqualifying, it is recommended that telegraphic inquiry be addressed to the Superintendent, U.S. Naval Academy, Annapolis, Md., U.S.A.
- Be proficient in reading, writing, and speaking idiomatic English and meet the following scholastic entrance requirements:

Candidates may qualify for admission by either of the following two methods:

- Certificates from accredited secondary schools and colleges of the United States of America.
- Taking the College Entrance Examination Board Scholastic Aptitude Test and achievement tests in English Composition and Intermediate or Advanced Mathematics. Detailed certificates covering school work will not be required of candidates qualifying by the examination method.

Candidates will be given the same examination in English composition as other candidates, but due consideration will be accorded these foreign students when evaluating test results. Each candidate shall submit a certificate from his government that he is conversant with the literature of his native country and that he has completed a course in the literature of his native language equivalent in general to 2 years of secondary school work in literature in the United States. In lieu of this certification, a candidate may produce evidence of having acquired the units of literature from accredited schools of the United States.

The naval attaché or a diplomatic representative of the United States in the candidate's country shall furnish a report as to the candidate's proficiency in the use of idiomatic English.

Governments should submit the names of candidates as early as possible in order that they may qualify for entrance by the end of March and enter the Naval Academy in late June or early July, except in the cases of candidates attending secondary schools and colleges in the United

States whose school records for the current year are essential to fulfillment of admission requirements. In such cases candidates may be granted until 25 June in order to permit completion of the required certificates. The nomination of the candidate should contain a statement of the method of admission under which he wishes to qualify.

In lieu of the oath of allegiance to the United States, a substitute oath will be required, in substance as follows:

"I, -----, a citizen of -----, aged ----- years ----- months, having been appointed a midshipman at the United States Naval Academy, do solemnly swear to comply with all regulations for the police and discipline of the Academy, and to give my utmost efforts to accomplish satisfactorily the required curriculum; do swear not to divulge any information of military value which I may obtain directly or indirectly in consequence of my presence at the United States Naval Academy to any alien government; and do agree that I shall be withdrawn from the United States Naval Academy if deficient in conduct, health, or studies."

Notification will be given to the governments that students found by proper authority to be unsatisfactory in conduct, studies, or health will be accorded the same consideration given other midshipmen regarding withdrawal from the Academy, or repetition of a year's work.

Preparatory Scholarships

A nonprofit organization, the U.S. Naval Academy Foundation, Inc., provides an educational assistance program to enable deserving young men to enhance their qualifications for admission to the Naval Academy. The foundation, a tax-exempt organization chartered under the laws of the State of Maryland, has no official connection with the U.S. Navy or with the U.S. Naval Academy.

The foundation provides a limited number of post-high-school preparatory scholarships annually to highly motivated and qualified young men seeking admission to the Naval Academy to prepare for a lifetime career in the Navy. The scholarships are awarded through preparatory schools to deserving young men who need financial assistance to achieve preparatory schooling.

The parents of young men selected for this program are expected to contribute financially as best they can afford. The foundation offers no assistance to individual boys in obtaining their appointments.

The foundation makes annual cash grants for these scholarships to specific preparatory schools in various parts of the Nation. Application must be made directly to the U.S. Naval Academy Foundation, Inc., 48 Maryland Avenue, Annapolis, Md.

Completed applications must be provided to the foundation by 1 April each year.

THE NAVAL OFFICER'S CAREER

A Way of Life

Inscribed in Latin above the bronze doors of the Naval Academy Chapel is the motto, *Not Self, But Country*—a motto which the young candidate embraces the moment he takes the oath as a midshipman and which will be a part of his being for the rest of his life. His education at the Academy has been designed for one purpose only: to prepare him for a lifetime career as a dedicated professional in the naval service. After 4 years of intensive study at Annapolis, he is ready to assume his responsibilities as an officer in the greatest Navy in the world.

This is a complex Navy—one whose ships range every ocean, whose officers and men not only sail the seas but who are engaged in construction and research from the tropics to the poles, whose supersonic planes have provided the training ground for America's first astronauts, whose nuclear submarines are a testimony to America's engineering genius, whose leaders advise in the highest councils of government, and whose Marines stand second to none where tales of valor are told. This is a vastly complicated and technological Navy, yet one in which the human being is, in the end, all-important. It is an organization which puts a high premium on leaders with vision, dedication, and ability. It is a Navy with a proud past and a promising future, broad enough to provide a stimulating challenge in a wide spectrum of interesting fields.

Catapult Launching in China Sea

Robert D. Moeser





Destroyer Wardroom

Robert D. Moeser

First Duty

A graduate's first career opportunity comes in his choice of branch of the service. The priority assigned his individual preference is dependent upon a number of factors, including his standing in class, the needs of the service, and his personal qualifications; but every attempt is made to assign him to the duty and locality of his first choice.

Nuclear Missile Frigate and Nuclear Carrier

Robert D. Moeser



Whatever his initial operational duty, he will usually find that his responsibilities are larger than those of his contemporaries in civilian life. Most Naval Academy graduates are commissioned as ensigns in the line and are, thus, ultimately headed for command at sea. The majority go to sea initially in a combatant-type ship—i.e., aircraft carrier, cruiser, destroyer, or amphibious craft—but some are kept ashore to attend specialized schools before joining the fleet. Included in this group are those graduates entering the nuclear submarine field and those headed for flight training and a career in naval aviation.

A small number are commissioned on graduation in the Civil Engineer Corps, in the Supply Corps, or as Engineering Duty officers. The civil engineer designees, after a short tour in a Public Works or Seabee outfit, proceed to a civilian university to pursue a postgraduate course. Supply Corps officers attend a special Navy school of several months' duration prior to their first operating assignment. The Engineering Duty officers (specialists in ship design, construction, and repair) will normally spend several months aboard ship before returning to postgraduate work. Those commissioned as Second Lieutenants in the Marine Corps are ordered to a course in basic training before joining regular Marine units.

Officer Education and Training

Upon graduation and commissioning, the new officer may lay his books aside momentarily, but his theoretical and practical education will continue as long as he is in the service. From graduation day forward, he will continue to prepare himself for assignments of greater responsibility and professional attainment by acquiring practical experience ashore and afloat and through advanced academic work. The extent of his attainment is limited only by his own ability, initiative, energy, and resourcefulness, commensurate with logical career planning.

The Naval Academy is considered but the first step in the educational ladder for the typical officer, and so the Navy sponsors a wide variety of programs, at both naval and civilian institutions, designed to prepare the officer for higher responsibility in the service of the United States. This move toward postgraduate education is begun in some cases before graduation, when a few midshipmen are selected to compete for scholarships in civilian universities. Most notable in this area, and the one in which Academy graduates have been most successful to date, has been the Rhodes scholarship, tenable at Oxford University.

As noted above, a small number of officers who have been selected for a specialty career in engineering will normally proceed to postgraduate work for the master's degree shortly after graduation. For the majority, however, Navy functional and basic technical courses

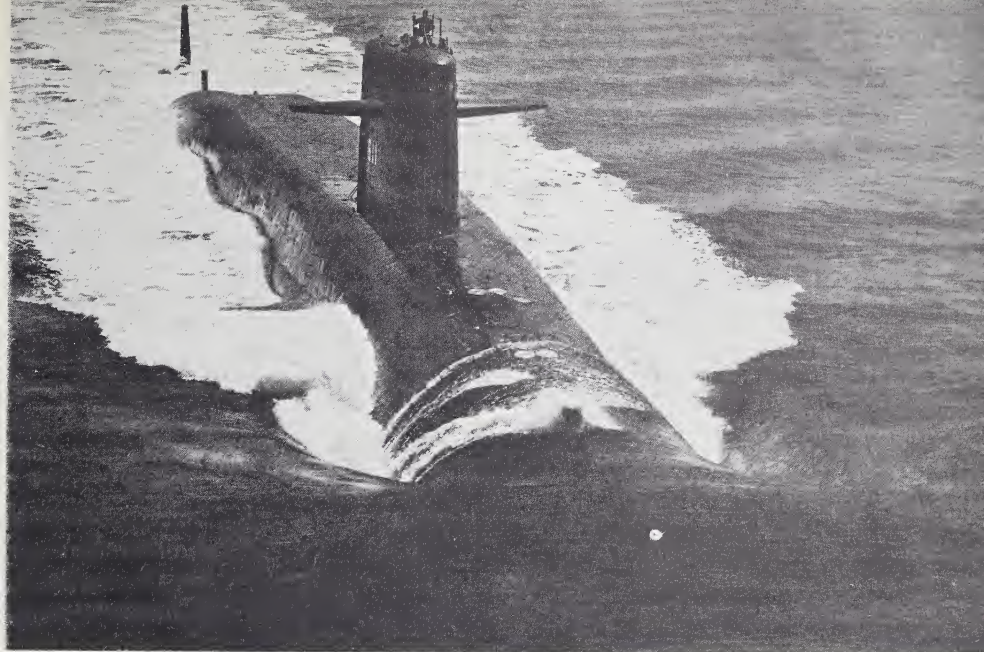


Headquarters, Naval Postgraduate School, Monterey, Calif.

provide their first post-commissioning training. Mostly of short duration, they are in such fields as communications, gunnery, antisubmarine warfare, damage control, electronics, and amphibious warfare.

After his first tour (3 to 6 years) of operational duty with the Fleet, the qualified Naval Academy graduate may expect orders to a postgraduate school for one or more years. Many fields of study are open to him, including, but not necessarily restricted to, those of mathematics, physics, general science, various types of engineering (nuclear and aeronautical, for example), management, international relations, and naval intelligence. For the best-qualified, the way is open to a doctorate. Courses are conducted at the U.S. Naval Postgraduate School, Monterey, Calif.; the Naval Intelligence School, Washington, D.C.; Test Pilot School, Patuxent River, Md.; and various civilian institutions such as Carnegie Institute of Technology, Harvard, MIT, Princeton, Rensselaer, Stanford, and Tulane.

It should be noted not only that opportunities for postgraduate work are afforded in the early years of commissioned service, but that they continue throughout an officer's career. Senior war colleges, in particular, are noted for bringing officers up to date on problems of international import and their effect on our global strategy. The officer who aspires to positions of high responsibility will, of necessity, have to continue to grow intellectually and thus to be part-student all of his professional life.



Nuclear Ballistic Missile Submarine

Officer Career Patterns

Within the framework of the needs of the service, an officer determines his own career pattern to a significant degree through his requests for assignments afloat and ashore, his advanced studies, and, of course, by his performance. Most graduates, after their first tour at sea, elect to continue as line officers, many of them requesting assignment at this time to flight or submarine training. A small

Amphibious Task Force





Navy Icebreaker in Arctic

number may apply to serve in more specialized fields, and are designated, as were some of their classmates at graduation, as Civil Engineer Corps, Supply Corps, or Engineering Duty officers. The careers of many of these specialists tend to concentrate in the industrial management field and, to some extent, in research and development, and much of their work is with the civilian world.

A line officer finds that tours of operational duty with Fleet components are alternated with assignments to bureaus, offices, and activities in the Navy's vast shore establishment. Experience at sea is of prime importance to this officer, for it is at sea that he increases his competence as a mariner and as a leader. The early years of experience at sea form a basis for his career which will include bringing his seagoing experience to the management of certain supporting shore facilities. Assignments are varied and interesting, and include not only military command but the opportunity to work with the civilian employees of the Armed Forces as well as with members of other services. In all assignments, individual preference is given careful consideration.

Officer careers continue along many paths, depending upon individual experience and background. After his postgraduate tour, a line officer may return to sea as a head of department in a destroyer or commanding officer of a smaller combatant vessel. Line officers who are aviators may expect to resume duty in an aircraft squadron



Flight Operations

based in a carrier or ashore. Others who are qualified in submarines will continue in duties preparing them for submarine command, which comes after about 12 years of commissioned service.

Every officer may expect to serve in billets in which his naval education will be most valuable. Many line officers qualify for a subspecialty which they exercise during periods of shore duty. These specialties include such varied fields as naval intelligence, oceanography, communications, meteorology, nuclear engineering, and aeronautical engineering. In addition, officers aspiring to command at sea will serve in a variety of ships or aircraft in different capacities, as well as in staff and planning billets afloat and ashore, in the United States and overseas, to prepare them further for command.

It is a satisfying, but demanding, life. The naval officer presents many faces to the world: Fleet Commander, engineer, scientist, diplomat, and educator. His is not just a job, but a way of life—a career dedicated to the service of the United States carrying with it high professional prestige and opportunities for broad experience—a career which rewards the industrious, the sincere, the adventurous, and the imaginative. The Navy is not a career field for those who prefer a soft life and who shy away from challenges. It is, rather, one for those to whom the homely virtues of the strenuous life, patriotism, and dedication to an ideal have a real meaning which can be translated into a lifetime of service in the Navy of the United States.

THIS IS THE NAVAL ACADEMY

The U.S. Naval Academy is the undergraduate college of the U.S. Navy. Its purpose is to educate and train young men for careers as officers in the naval service. The Academy is accredited by the Middle States Association of Colleges and Secondary Schools. Graduates of its 4-year course are awarded the bachelor of science degree and are commissioned ensigns in the U.S. Navy or second lieutenants in the U.S. Marine Corps.

Located at the mouth of the Severn River on Chesapeake Bay in Annapolis, the historic colonial capital of Maryland, the Academy is 30 miles east of Washington, D.C., and 25 miles south of Baltimore. Visitors are welcome during daylight hours. Information and a map of the Academy are available at the entrance gates.

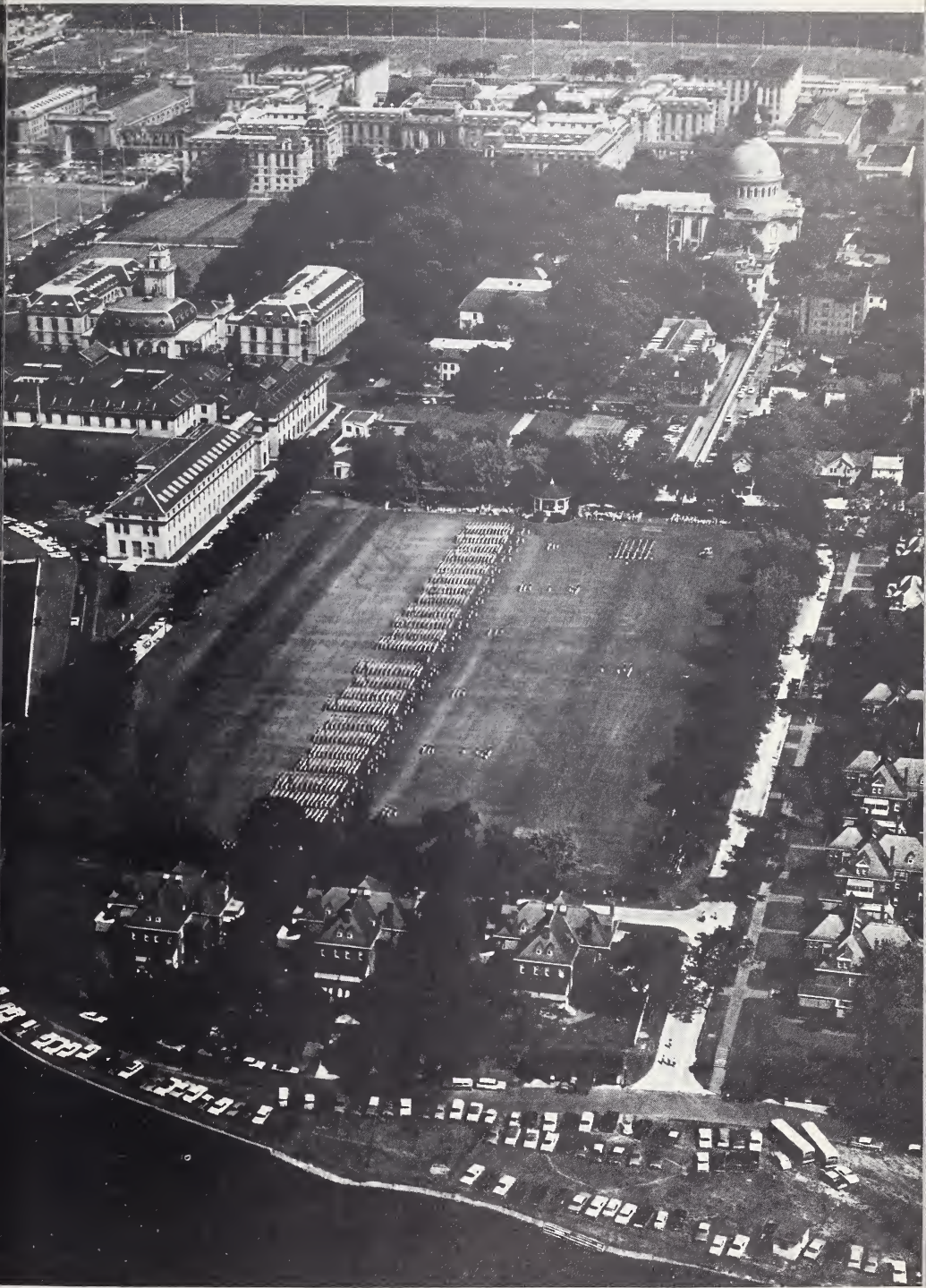
Through the Years 1845–1965

The Naval Academy was founded as the Naval School in 1845 by the Honorable George Bancroft, distinguished historian and educator and Secretary of the Navy in President Polk's Cabinet. Its site, Fort Severn, was obtained from the War Department. The first Superintendent was Commander Franklin Buchanan. His eight-member faculty of five officers and three civilians taught gunnery, naval tactics, engineering, chemistry, mathematics, astronomy, French, and English. Sixty midshipmen, formed in two classes, attended the Academy's first convocation.

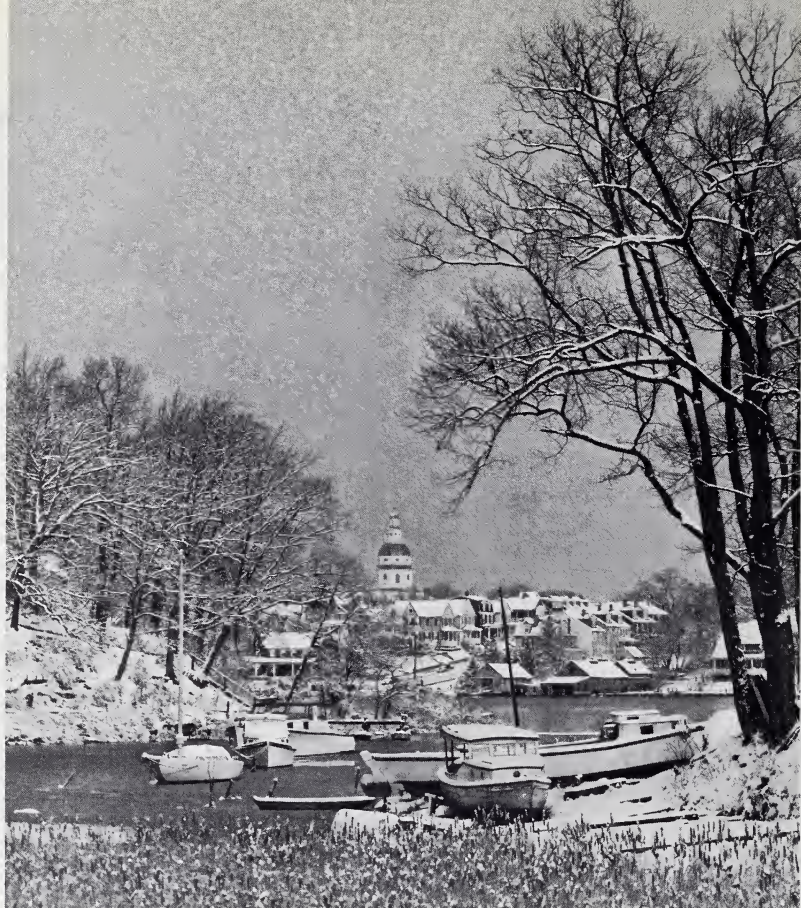
Prior to 1845, the majority of a midshipman's training was conducted aboard ship under the ship's chaplain. Supplementary training was provided from time to time at various schools ashore. These included a short-lived school in the Washington Navy Yard established in 1803 and a Naval School established in Philadelphia in 1839 to provide an 8-month preparatory course for midshipman promotion examinations.

Initially the course was 5 years. Of these, only the first and last were spent at the new Naval School in Annapolis. The intervening three were spent at sea. In 1850–51 the Naval School was reorganized as the U.S. Naval Academy and the course of study became 4 consecutive years. Summer practice cruises replaced the omitted sea service. Thus, today's basic 4-year curriculum first appeared at the Naval Academy over 100 years ago, long before it became general practice in American undergraduate education.

During the Civil War the Academy was moved temporarily to Newport, R.I. Following the war, it was returned to Annapolis, where it has since remained. During these early years the Academy was unique



The U.S. Naval Academy



Annapolis Winter Scene, Statehouse in Background

M. E. Warren

in American educational experience in that it was one of the few institutions offering a sophisticated undergraduate course in technical education. In 1879 this excellence was recognized by the Paris Exposition in the form of a certificate for "the best system of education in the United States."

In the late 1870's, Albert A. Michelson, a graduate of the class of 1873, performed his world-famous experiment measuring the velocity of light while serving as an instructor in the Department of Physics and Chemistry at the Academy. Michelson continued his brilliant scientific work after leaving the Navy, and in 1907 he became the first American to receive the Nobel Prize in physics. Thus, it is little surprising to note that the name selected for the Academy's projected new science building is Michelson Hall.

Other distinguished graduates have included Mahan, whose thoughtful writing on seapower and its influence on history is still the world standard in its field, and an uninterrupted succession of distinguished military leaders going back through peace and war for over 100 years.



Midshipman Bancroft, Brigade Commander and Rhodes Scholar

Such men as Admirals Dewey, Sims, King, Nimitz, Halsey, Burke, and Rickover need no introduction. Neither do astronauts Shepard and Shirra. Their successors and heirs to their greatness are midshipmen today.

As the Nation's need for seapower has grown through the years, the Navy has increased greatly in size and complexity. Keeping pace, the Academy has continued to meet every challenge, expanding its facilities and revising its curriculum as necessary to provide the timely, second-to-none leadership expected of the American Navy.

From 1873 to 1912 the academic course was 6 years, with the last 2 being spent at sea. In 1912 the requirement for 2 years at sea was eliminated and the curriculum reverted to 4 years. And, with the exception of temporarily shortened curriculum during the war years, it has remained 4 years until today.

In 1930 Naval Academy graduates won six Rhodes scholarships, a record that still stands. A 1933 congressional law authorized the Acad-

emy to award the Bachelor of Science degree. In 1958 the College Entrance Board Tests were adopted in lieu of the entrance examinations previously prepared by the Academy.

Midshipmen have won a number of recent academic honors. Two graduates from the Class of 1962 are currently studying at Oxford on Rhodes scholarships. In 1964 five midshipmen won Fulbright scholarships, enabling them to undertake study and travel in Europe, South America, and the Middle East. The most recent Rhodes scholar is in the Class of 1965.

Academy debaters had a distinguished 1963-64 season, culminating in an award for fourth place in the National Debate Tournament. So far this academic year midshipmen debaters have already surpassed last year's record, carrying off nine trophies and awards to date.

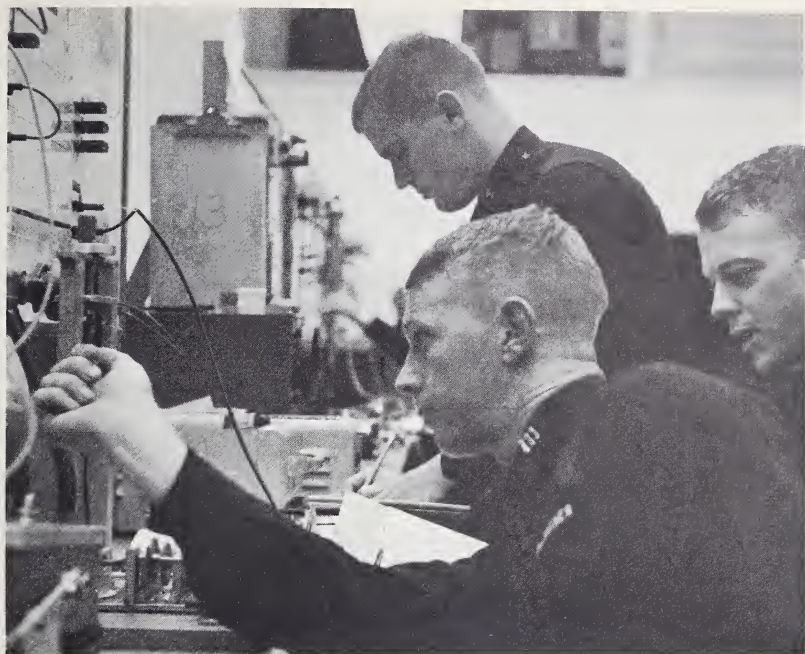
The Academy has established a notable record in studies of international affairs. Last spring 160 students from 100 schools attended the Annual Naval Academy Foreign Affairs Conference. High State Department officials as well as foreign ambassadors and representatives from 20 embassies took part in the conference.

Recent Curriculum Changes

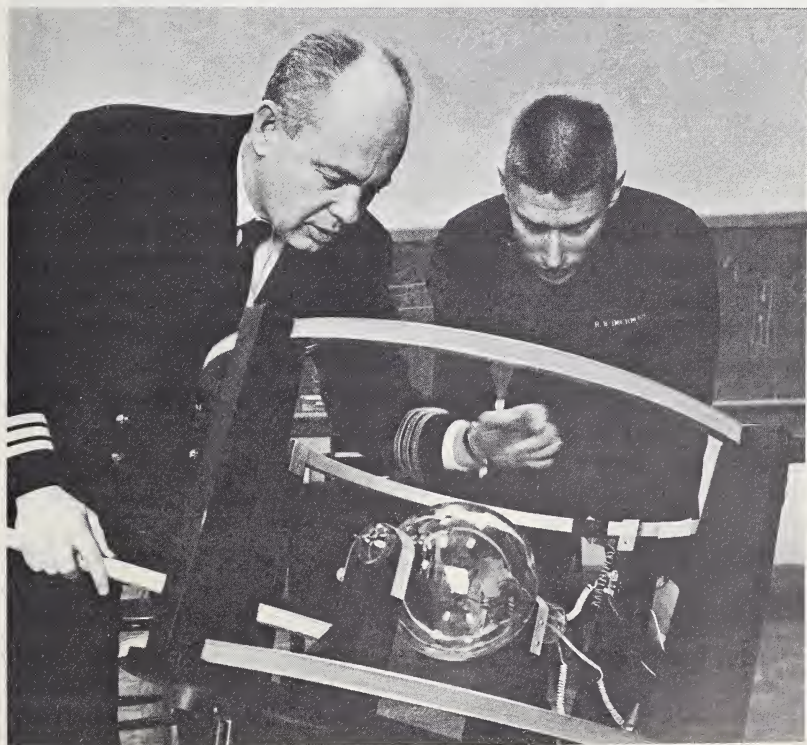
The rush of science and technology in recent years has spurred revolutionary changes in the Navy and in the Academy's curriculum. Discussed in greater detail on succeeding pages, these changes began in 1959 with provision for incoming midshipmen to validate previous college-level work. Concurrently with validation, there was a broadening of course offerings and qualified midshipmen were encouraged to carry more than the minimum number of courses.

This was followed in 1963 by the appointment of a civilian Academic Dean (pro tem); the initiation of the Trident Scholarship Program, under which a small number of exceptional students are permitted to pursue independent research during their first class (senior) year; and the conversion of the Academy's traditional 4.0-based marking system to the more widely used letter-grade system. In addition, a special Ph. D. program was established in which a limited number of highly selected midshipmen go directly into graduate work leading to a doctorate. Five midshipmen from the Class of 1964 began these studies at Harvard, Stanford, and the University of California. Each was accepted by the university of his first choice.

The 1964-65 academic year brought the Academy's most recent organizational changes and continued the liberalization of the curriculum. Organizational changes included the establishment of the civilian line positions of Academic Dean and Dean of Admissions reporting directly to the Superintendent. Academic departments were placed directly under the Academic Dean.



Jack Engeman



Although sweeping, the latest curriculum changes follow logically the provisions for validation and electives initiated in 1959. In order to reduce formal course requirements and thus facilitate study of individual subjects in greater depth, total semester hours required for graduation were reduced from 164 to a more realistic 137-143. In addition, greatly increased flexibility was assured for individual programs of study by providing that 15 percent of these semester hours be devoted to electives. Concurrently the number of elective courses offered was increased to 85, and a total of 23 minors and 21 majors were offered. And, finally, selection of a minor by midshipmen at the completion of their fourth class (freshman) year was made mandatory beginning with the Class of 1968.

Increasing numbers of midshipmen have taken advantage of the flexibility offered by the Academy's validation and elective programs to pursue advanced undergraduate elective study. Reflecting this trend, the last entering class validated 1,134 courses and the last graduating class fulfilled academic requirements for 152 majors.

Facilities

Physical and academic facilities have kept pace with the demands of the curriculum and the Fleet. Fort Severn's original 10 acres has grown to today's 302 acres. Bounded by the water and the city of Annapolis, much of this increase has of necessity resulted from a series of landfills in the Severn River. The most recent landfill, completed in 1959, added 56 acres for athletic fields and new buildings. Construction of buildings in the present French Renaissance style began in 1899 with a congressional appropriation of \$10 million. The renowned Earnest Flag of New York was the architect.

Recent years have seen the addition of new wings to Bancroft Hall, the midshipmen's dormitory; the construction of a new Brigade Library and Assembly Hall; the construction of a new athletic fieldhouse, large enough to accommodate the entire 4,000-man Brigade of Midshipmen with families and friends of First Classmen (seniors) at graduation; and the construction, with privately donated funds, of the nearby Navy-Marine Corps Memorial Stadium. In addition, a complete multimillion-dollar renovation of six of Bancroft Hall's eight wings is nearing completion. A new master 6-year \$55 million construction and rehabilitation plan is underway. The key structure in this plan to help the Naval Academy fulfill its obligation in the nuclear age is the new science building, Michelson Hall.

The center of midshipman activity in today's Yard is Bancroft Hall, the largest and surely one of the most beautiful dormitories in the world. Stretching over many acres, and so large that it must be



U.S. Naval Academy Chapel

C. W. Wloszek

viewed from the air to be seen in its entirety, it houses the entire Brigade as well as providing facilities for recreation and basic daily needs.

Sharing the spotlight in the Yard is the tall, beautiful, and familiar Chapel dome, beneath which lies the crypt of America's renowned Revolutionary War hero, John Paul Jones. Throughout the Yard stand other monuments and mementos commemorating great men and deeds of our Navy and perpetuating its traditions.



A Happy Graduate Receives His Diploma

THE ACADEMIC PROGRAM

The 4-year academic program of the Naval Academy is undergraduate in scope and leads to the Bachelor of Science degree. One hundred and thirty-seven semester hours are required for graduation. Eighty-five percent of this 4 years' work is called the *core curriculum* and is devoted to basic courses in physical and engineering sciences, social sciences and humanities, and naval science. The midshipman's selected minor makes up the remaining 15 percent of the 4 years' work. This program allows each midshipman the choice of a discipline to study in depth (normally 18 semester hours).

As a supplement to this curriculum, the Naval Academy offers a broad program of elective courses and provisions for validation of college-level work successfully completed prior to admission. The selected minor program may be developed into a major by qualified midshipmen by use of validation and/or by completing selected additional courses (overloads). In most cases six additional courses make up the major. A complete listing of core courses, minors programs, majors programs, and course descriptions are shown for departments on pages 99 through 174.

The basic program thus provides *all* midshipmen with the educational background required for effective naval officer leadership, and an educational experience in study in depth. At the same time the program provides the opportunity to undertake advanced undergraduate work for fuller development of individual talents.

The awarding of the Bachelor of Science degree to graduates of the Naval Academy is authorized by the act of Congress approved 25 May 1933, as amended by the act of Congress approved 8 July 1937. The degree is accredited by the Middle States Association of Colleges and Secondary Schools.

The Academic Organization

Responsibility for direction of the Naval Academy is vested in the Superintendent. This position is held by a naval flag officer. The Superintendent is assisted by the Commandant of Midshipmen, who is responsible for directing the military and physical training and the administration of the Brigade of Midshipmen, and by a civilian Academic Dean, who supervises the academic curriculum and academic standards.

The Superintendent, the Commandant, the Dean, and other senior members of the faculty comprise the Academic Board, which makes major academic decisions and sets the academic standards of the Academy. There are seven academic departments: Engineering;



The Faculty Includes Officers From Five Foreign Countries

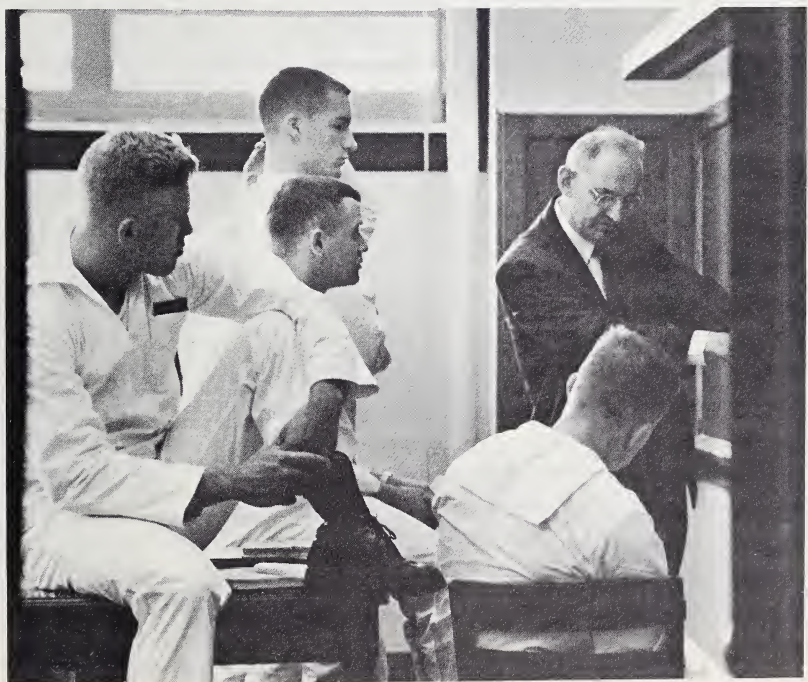
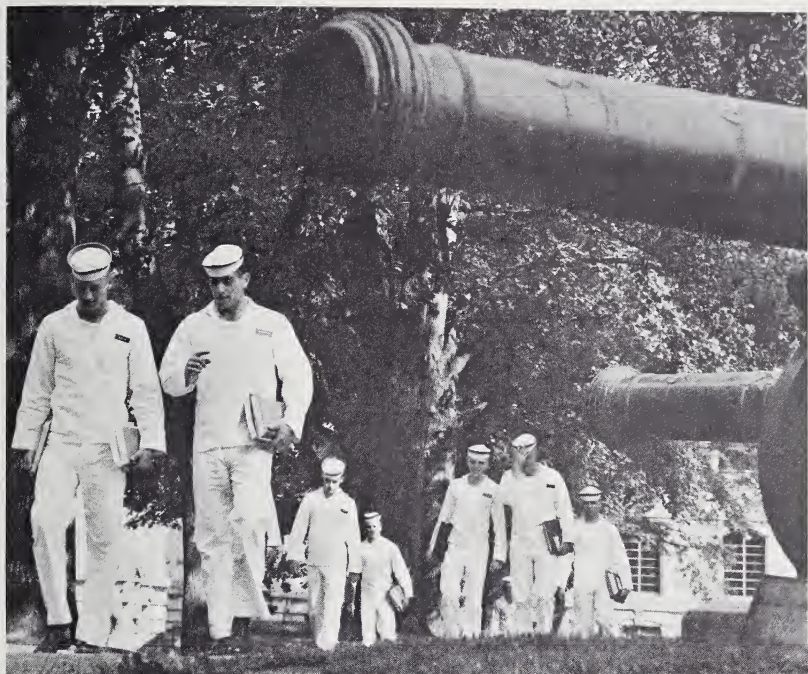
English, History, and Government; Foreign Languages; Mathematics; Naval Science; Science; and Weapons, each headed by a Navy captain who reports directly to the Academic Dean.

The Faculty

When Commander Buchanan, first Superintendent of the Naval Academy, included three civilian teachers among his seven-man faculty, he founded a policy which has borne the test of more than a century. Today the Naval Academy faculty, which has grown to more than 600, is still an integrated group of officers and civilians in about equal numbers. The officers, rotated at about 3-year intervals, provide a continuing input of new ideas and experience from the Fleet. The civilians provide a core of professional scholarship and teaching experience as well as continuity to the educational program of the Academy.

Well over 100 different colleges and universities in the Americas and Western Europe are represented in the backgrounds of the Academy faculty. Most officer faculty members are naval (or marine) officers, but all the Armed Forces are represented. Foreign officers also serve through exchange programs to instruct in their native languages and in other subjects and to provide midshipmen an early insight into the international aspects of naval life.

A policy of assigning the best qualified instructor for the specific course determines the distribution of the officer and civilian faculty among the academic departments. For example, the Naval Science



and Weapons Departments are staffed largely by officers, whereas civilian instructors are in the majority in the English, History, and Government Department and the Foreign Languages Department.

Members of the Naval Academy faculty participate in local and national meetings of educational and professional societies. As advisers and coaches, they work closely with the midshipmen in their extracurricular activities. As scholars, they contribute to the literature of their specialties, prepare texts for midshipman instruction, and conduct research projects in this country and abroad.

A complete listing of Naval Academy faculty by departments is given on pages 179 through 205.

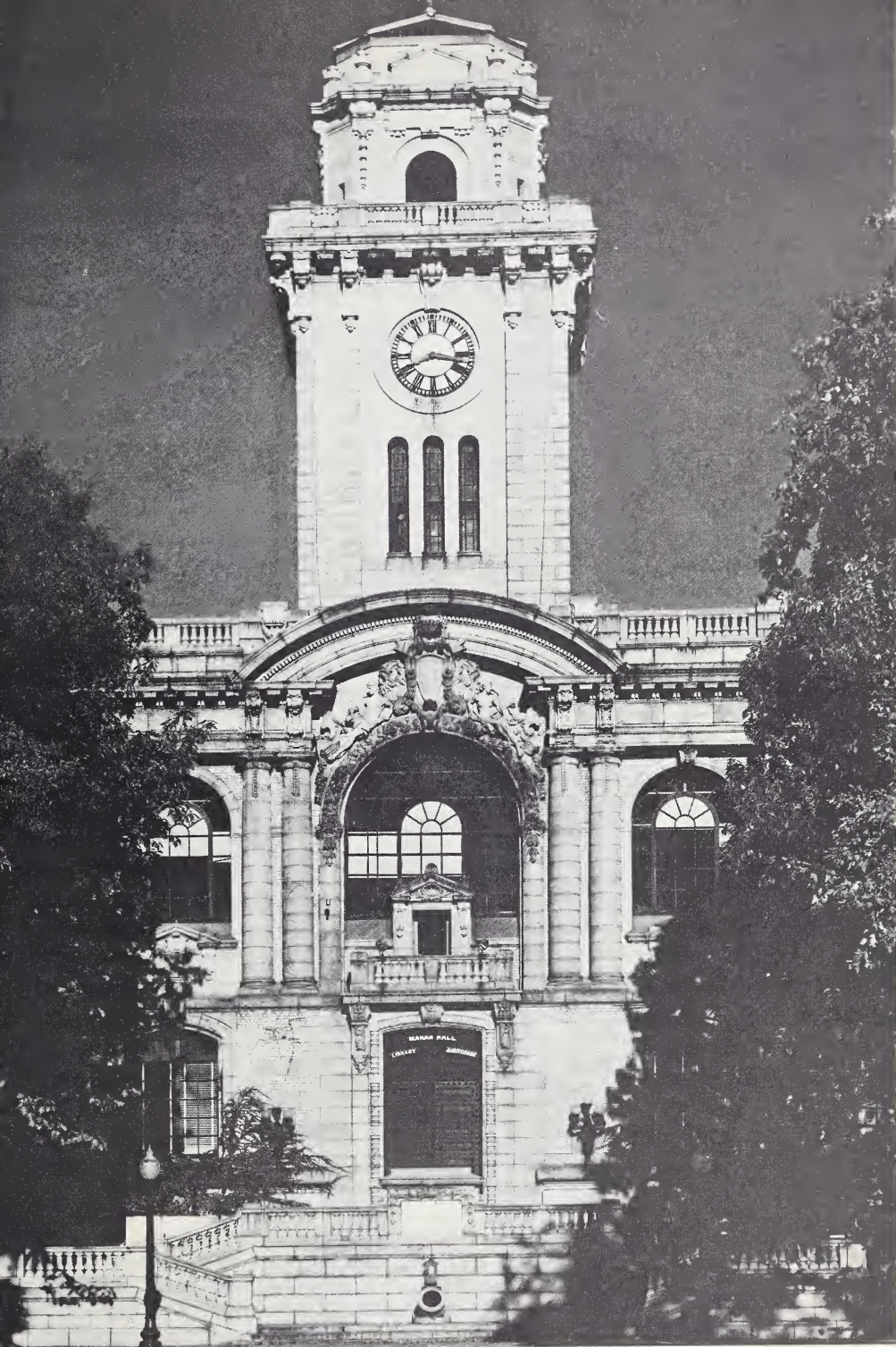
The Schedule of Instruction

The calendar year for each Naval Academy class is divided into two semesters and a summer term. The academic year consists of the first and second semesters, each semester generally consisting of 17 weeks of instruction and 1 week of examinations. Midshipmen normally carry about 18 semester hours of academic courses. The normal academic routine provides for 5½ days of recitations, lectures, laboratory periods, and drills each week. Academic days are divided into seven periods of 50 minutes, Monday through Friday, and four periods on Saturday morning. During the seventh period, the Brigade participates in military drill on Monday and a dress parade on Wednesday in the fall and spring. Some elective courses are taught the seventh period on Tuesdays, Thursdays, and Fridays. A four-hour evening study period is provided every evening except Saturday. Some periods during the day are also allocated to study.

The instructional unit is a section of about 15 midshipmen. These small sections give each midshipman an opportunity to ask questions and to take an active part in classroom discussion. The high ratio of instructors to students (about 1 to 7) normally makes it possible to assign no more than three or four sections to an instructor. Individual attention is thus characteristic of education at the Naval Academy.

The Core Curriculum and Minor

Every midshipman must take the *core curriculum* plus a selected minor. He may, however, omit courses for which he validates comparable college-level work as noted following "Advanced Placement Program." The core curriculum is designed to give the midshipmen the essential education in science, engineering, social science and humanities, and naval science that he will need to perform effectively as an officer in the Naval Service. This is his major field of academic endeavor. The courses of the *core curriculum* with semester hours, and various drills and lectures follow on the next page.



The Main Library

THE CORE CURRICULUM

Fourth Class Year*

	First Semester	Hours Class-Lab		Second Semester	Hours Class-Lab
H101	Composition and Literature	3-0	H102	Composition and Literature	3-0
L101	Foreign Languages	3-0	L102	Foreign Languages	3-0
M111	Calculus I	4-0	M120	Calculus II	4-0
N105	Air-Ocean Environment	3-0	N106	Introduction to Psychology and Management	3-0
S101	Chemistry	3-2	S102	Chemistry	3-2
T101	Physical Education (Drill)		P102	Seabreeze (YP Craft) (Drill)	
X101	Executive (Drill)		T101	Physical Education (Drill)	
			X101	Executive (Drill)	
		16-2			16-2
	Sem Hrs	17		Sem Hrs	17

Third Class Year

	First Semester	Hours Class-Lab		Second Semester	Hours Class-Lab
E207	Solid Mechanics	3-2	E208	Engineering Materials	3-2
H201	Modern European History	3-0	M220	Differential Equations	4-0
M211	Calculus III and Probability	4-0	N206	Navigation	3-2
S211	Physics	3-2	S212	Physics	3-2
....	Elective	3-2 or 3-0	Elective	3-2 or 3-0
T201	Physical Education (Drill)		P200	Seapower II (Lecture)	
X201	Executive (Drill)		T202	Physical Education (Drill)	
			X202	Executive (Drill)	
		16-4/6			16-6/8
	Sem Hrs	18/19		Sem Hrs	19/20

***Note.** Fourth Class Summer includes placement and validation tests; library briefings, and lectures on history and traditions (English, History, and Government); trigonometry for certain midshipmen (Mathematics); professional and lectures (Naval Science); orientation, infantry drills, and hygiene lectures (Executive); and an introduction to the digital computer and rifle and pistol drills (Weapons). No academic credit is granted for Fourth Class Summer.

Second Class Year*

First Semester			Second Semester		
		Hours Class-Lab			Hours Class-Lab
H303	U.S. Government and Constitutional De- velopment	3-0	H304	Economic Analysis	3-0
M305	Vector Mechanics	3-0	N316	Naval Operations Analysis II	3-0
N315	Naval Operations Analysis I	3-0	S206	Modern Physics	3-0
S305	Introduction to Elec- trical Science	3-2	S306	Applications of Elec- trical Science	3-2
.....	Elective	3-2 or 3-0	Elective	3-2 or 3-0
T301	Physical Education (Drill)		P302	Seabreeze (YP Craft) (Drill)	
X301	Executive (Drill)		T302	Physical Education (Drill)	
			X302	Executive (Drill)	
Sem Hrs		15-2/4 16/17	Sem Hrs		15-2/4 16/17

First Class Year

First Semester			Second Semester		
		Hours Class-Lab			Hours Class-Lab
E311	Elements of Thermo- dynamics	3-2	E312	Elements of Fluid Mechanics	3-2
H403	History of Sea Power	3-0	H404	Reading in Western Ideas	3-0
N409	Management and Military Law	3-0	H406	Foreign Policy	3-0
W409	Fire Control Systems	3-2	W412	Terminal Ballistics	3-2
.....	Elective	3-2 or 3-0	Elective	3-2 or 3-0
P401	Basic Form Tactics (YP Craft) (Drill)		P402	Advanced Formation Tactics	
P403	Counterinsurgency (Lecture)			(Seabreeze) (Drill)	
T401	Physical Education (Drill)		T402	Physical Education (Drill)	
X401	Executive (Drill)		X402	Executive (Drill)	
			Y402	Hygiene (Lecture)	
Sem Hrs		15-4/6 17/18	Sem Hrs		15-4/6 17/18

*Note. Second Class Summer includes E300, Ship Hydrostatics (Buoyancy and Stability); H300, Speech; and W300, Digital Computers. Contact hours total 46 for these courses and 1¾ semester hours credit is granted. The summer also includes P303, Practical Navigation; P300, Line Tactics; and P301, Sea-power III. Contact hours for these courses total 70. No credit is granted for these courses.



Grading

In September 1963 the Naval Academy converted its traditional 4.0 to 2.5 numerical grading system to the letter-grade system wherein individual grades of A, B, C, D and F (A denoting excellent and F, failing) are assigned numerical Quality Point Equivalents (QPE) of 4.0, 3.0, 2.0, 1.0, and 0.0, respectively.

Grades are averaged using a weighted semester hour system called a Quality Point Rating (QPR). The QPR is computed by multiplying the QPE corresponding to the letter grade received in each course by the semester hours of credit for the course and dividing the sum of these products by the total number of semester hours represented by all of the courses taken. A Semester QPR is computed only for courses taken during a given semester. A Cumulative QPR is maintained for each midshipman. It includes all academic marks assigned to date. This grading system is similar to that used by most colleges and universities. A Semester QPR of 2.00 is the minimum passing grade for the semester, and a Cumulative QPR of 2.00 or above is required for graduation and commissioning.

An academic probation system functions as a warning system to midshipmen who are not making satisfactory progress toward graduation. A midshipman will be placed on academic probation at the beginning of a semester following that in which his Cumulative QPR drops below 2.0. He will also be placed on probation for the semester following two consecutive semesters that his Semester QPR is below 2.00 even though his Cumulative QPR remains above 2.00. A midshipman may be discharged for: semester failure of one or more subjects; failure to improve sufficiently after being on probation for one semester; or, failure to achieve a Semester QPR of at least 1.5 for a given semester.

On the other end of the grading scale, two honor categories are available to midshipmen. The Superintendent's List honors all midshipmen who are graded a "B" average in all areas (including aptitude, conduct, and physical education), and the Dean's List honors all midshipmen who score a Semester QPR of 3.4 or better in academic subjects.

The Advanced Placement Program

Midshipmen are authorized to omit courses in the *core curriculum* which are substantially the same courses they have satisfactorily completed elsewhere before coming to the Naval Academy. This privilege, called validation, is granted on the basis of review of previous scholastic records and examination by the department which offers the course for which substitution of the validation is sought. Candidates are encour-

aged to submit College Entrance Examination Board Advanced Placement Test results as substantiation for validation.

Midshipmen validating previous work are able to substitute advanced elective courses toward a selected major or field of interest. Each midshipman is assigned a faculty counselor to assist him in selecting his electives and in planning a profitable and acceptable program for his minor and/or major.

The Minors and Majors Program

As described under "The Academic Program," all midshipmen must take a minor, a selected sequence of six courses (electives) in one of the disciplines shown below. This program may be expanded into a major in the same discipline through the completion of additional courses. Minor and major disciplines offered are listed below by departments:

Department	Minors/Majors
Engineering Department	Aero Space Mechanical Engineering Naval Engineering
English, History, and Government Department	History Literature Foreign Affairs Politics and Economics
Foreign Languages Department	French German Italian Portuguese Russian Spanish
Mathematics Department	Mathematics (minor) Applied Mathematics (major) Theoretical Mathematics (major)
Naval Science Department	Oceanography Management Operations Analysis
Science Department	Chemistry Physics Nuclear Science (minor only) Electrical Science (minor only)
Weapons Department	Systems Engineering (Weapons)

Midshipmen being certified for a major must have a Cumulative QPR of at least 2.30 and no grade below a C in any course which is counted toward a major.

Trident Scholars

The Naval Academy instituted the Trident Scholars program in order to provide a small number of exceptionally capable students with an opportunity for an experience in independent research during their first class year. Midshipmen of the Second Class, standing in the top 10 percent of their class at the end of the year, are invited to submit proposed projects for research. Six Scholars were selected in both 1963 and 1964.



Scholar and Advisor

Jack Engeman

Scholars are excused from formal course requirements, but may enroll in or audit courses as they desire. Each Scholar works independently on his research project and is assigned a faculty adviser who is well acquainted with the field in which the Scholar is working. Travel in connection with research is fully supported.

There is also a Trident Scholar Committee of faculty members with special interest in research. The Scholars, their advisers, and the Committee meet monthly for dinner and to discuss the progress being made by the Scholars. The Scholar submits a thesis on his research project as the basis for his academic grade for the year.

Project titles of the current Scholars are: "Prediction of Performance of Solid Propellant Rocket Propulsion Systems"; "The Problems of

Service Orientation, Motivation, and Dedication"; The Effect of Micro-molecular Solutions on Drag and Turbulent Flow Noise"; "Continuity and Change in French Military Policy From the Fourth to the Fifth Republic"; "Adaptive Threshold Logic Circuits"; and "Extension of Dedekind Cuts to Generalized Boolean Algebras."



Dr. Wernher von Braun Addresses Midshipmen

The Evening Lecture Program

Midshipmen of the First and Second Classes are afforded an opportunity to broaden their knowledge and outlook through evening lecture programs. Lectures for the First Class concern the fine arts and world affairs; those for the Second Class are oriented toward science and engineering. Recent lecturers have included such personalities as Prof. John Ciardi on poetry; Mr. Nicholas Katzenbach; Dr. Wernher van Braun on space; Dr. Howard Mitchell on music; Dr. Harlow Shapely on astronomy; and Dr. H. L. Shapiro on anthropology.

Naval Academy Foreign Affairs Conference

Now an eagerly awaited annual spring event, the 4-day Naval Academy Foreign Affairs Conference has been an unqualified success since the initial Conference in 1961. The subject was "United

States Foreign Policy in Africa and the Middle East," which, coincidentally was again the topic in 1965.

At these conferences, distinguished civilians, military leaders, representatives of the U.S. Department of State, and foreign diplomats join with midshipmen of the Naval Academy's Foreign Affairs Club



and representatives from as many as 100 colleges and universities in a detailed study of U.S. foreign policy in the area selected for discussion.

Conferees are divided into groups for roundtable discussion of subareas. Roundtables are each moderated by an adult specialist in the subarea. To provide additional background to conferees and to assist them in their discussions, conference schedules include addresses in plenary session and a panel discussion, all by outstanding figures. In addition, ambassadors or other ranking diplomats discuss their country with each roundtable.

Resolutions are adopted by each table which are designed to deal effectively with U.S. foreign policy problems in their area. Deliberations culminate in a final plenary session in which these individual resolutions are debated, amended, and adopted.

Conferences are planned and organized by midshipmen of the Naval Academy Foreign Affairs Club and the English, History, and Government Department. The financial support is provided by private foundations and corporations.



THE MILITARY PROGRAM

The Commandant of Midshipmen

The Commandant of Midshipmen commands the Brigade of Midshipmen. He develops its character; endeavors to instill the highest ideals of duty, honor, and loyalty; provides military indoctrination and physical development; and inculcates midshipmen with the high standards of performance required of midshipmen and officers of the naval service. In carrying out these responsibilities, the Commandant coordinates the functions of the Executive, Medical, Dental, Midshipmen Services Activities, and Physical Education Departments which are directly under his cognizance. The Commandant is assisted by the Deputy Commandant who is also the Head of the Executive Department.

The Executive Department

The officers of the Executive Department work directly with the Brigade of Midshipmen. Assigned duties in Bancroft Hall as battalion, company, and staff officers, they work and live in close daily contact with the midshipmen. Here by precept and example; the application of sound techniques of leadership; counsel and guidance; and, when required, corrective or disciplinary action, the midshipman is measured, molded, and motivated for the day when he will join the Fleet as an officer worthy of those who have gone before him.

The Brigade and the Military Program

The military program at the Naval Academy sets it apart from most other institutions of higher learning. As a college designed to produce naval officers and not just graduates, the Academy has a broader mission. True a sound education is an essential goal, but also essential in the evolutionary process of producing naval officers are the development of character, leadership ability, motivation, moral strength, and physical skills and stamina. Thus, challenging and greatly rewarding in many ways, life at the Academy is purposeful, disciplined, and military.

For purposes of military training and administration, the 4,000-man Brigade of Midshipmen is divided into two regiments, each divided into three battalions. The six battalions are each divided into six companies. Midshipmen of all four classes are assigned to each basic military unit. The company is the basic unit for numerous competitive activities.

Each of these military units from the brigade down to the 36 companies and their subordinate platoons is under the command of a first classman, assisted by his midshipman staff and assistants. Midshipmen are selected by officers of the Executive Department for these commands and staffs in recognition of their leadership and officerlike qualities.

Plebe Indoctrination

The incoming midshipmen are officially designated "Fourth Classmen," but are colloquially known as "plebes." In succeeding years they become Third Classmen or "youngsters," Second Classmen, and finally, in their senior year, First Classmen.

The new plebes undergo an intensive program of military training and indoctrination from their first day at the Academy, which continues unabated until the end of plebe year the following June. During this period they early learn that they are senior to no one and junior to all, so that the "advice" comes from all directions and in many forms.

Known as "plebe indoctrination," the primary objective of this system is to speed the transition from civilian to military life and thus provide a base for rapid development of the attributes required of a naval officer. The indoctrination includes watch standing, drills, inspections, instruction, and discipline where necessary.

Plebe Year is tough. It is a deliberate period of testing, requiring midshipmen to stand on their own two feet, to produce under pressure, to respond promptly and intelligently to orders, and, finally, to measure up to high standards of character, honor, and morality. Plebe indoctrination is administered by midshipmen of the First Class, assisted by the Second Class, and closely supervised by officers of the Executive Department.

Weekly Routine

The weekly routine for a midshipman gets off to a rousing Monday-morning start with 6:15 reveille. Thirty minutes later, shaven and smartly dressed, he is undergoing his first inspection of the day at breakfast formation. After breakfast he straightens up his room and gets ready for his 0745 class, beginning a day of recitations, drills, laboratory work, recreation, and study.

Morning classes end at 11:55 and the midshipman gets ready for noon meal formation, a daily military highlight. Shoes are sparkling, gold is shining, and uniforms are brushed and smartly pressed.

Following lunch and a few moments of relaxation or last-minute study in his room, the midshipman departs for his 1:15 class. Classes end for the day at 3:05. Shortly thereafter uniforms have disappeared, and a frenzy of activity seems to erupt simultaneously at athletic fields, gymnasiums, indoor athletic facilities, on nearby waters of the Severn River and Chesapeake Bay, and at extracurricular facilities . . . literally at every point of the compass. Easily the best part of the day for most midshipmen, this activity is ended too quickly by the 6 p.m. evening meal formation.

Following the evening meal and a brief period for relaxation, studies resume for the remainder of the evening. Taps sounds at 10 p.m.



Plebe Year



Noon Meal Formation

during the week, but studies may continue for limited periods until "lights out." Thus go Monday through Friday, a lot of fun and a lot of work.

Saturday morning classes are followed by noon formation, accompanied by a rigorous inspection marking the end of the academic week. All midshipmen have liberty in Annapolis on Saturday afternoon, but many prefer to watch or participate in athletics, to sail, or to enjoy other recreational activities.

Midshipmen First, Second, and Third Class also have liberty in Annapolis on Saturday evening. Some attend the weekly movie in Mahan Hall, and many attend the scheduled "hop" or dance. Hops vary from formal during such times as June Week, Homecoming Weekend, and Christmas to informal. Music is provided by the Academy's U.S. Navy Band and, on less formal occasions, by midshipman bands.

Midshipmen attend church services on Sunday morning, either in the Naval Academy Chapel or the church of their choice in Annapolis. Sunday afternoon offers more liberty in Annapolis for the three senior classes. Midshipmen are free to show guests around the Naval Academy and are frequently found escorting family, friends, or best girl.

The Development of Leaders

Leadership is both an art and a science. There is no doubt that some men have more flair for leadership than others. At the same time, the basic principles of good leadership are well known and long established. Thus, properly instructed and trained, every man can become a more effective leader. The 4 years at the Academy provide each midshipman with the basic knowledge, guidance, motivation, and experience to become an effective leader. It all starts the first day . . .

Plebe Year

The first day of Plebe Summer is one that most midshipmen remember for many years. This is not surprising. In one short day civilians have become midshipmen. They are given haircuts, issued uniforms, taught the basics of marching, and eat their first meal in the 4,000-seat midshipmen's messhall. Their military indoctrination has gotten off to a running start. But they are too busy to worry about it. Civilian ways and days soon seem far behind.

As the summer progresses, the new midshipmen rapidly assimilate basic skills in seamanship, navigation, and in gunnery. Infantry drill, firing an M-1 rifle under the supervision of U.S. Marines, sailing navy yawls, and cruising in yard patrol craft make the midshipman a proudly versatile young man. Spirit and a desire to win are developed through competition in numerous activities, including boxing, talent shows, dress parades, and seamanship.



Midshipman Officers of the Brigade Staff

Plebe Summer is completed in late August with Parents' Weekend, at which time the parents of the new midshipmen have the opportunity to visit the Academy and observe their sons' progress. Exhibitions in sports, a dress parade "officered" by the new plebes, sailing, and a talent show go far to assure parents that their son is now a midshipman!

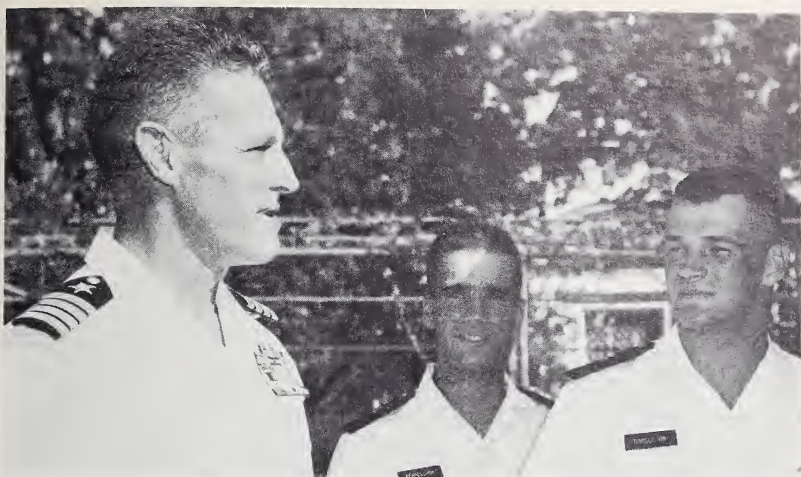
September arrives. Upperclassmen return from cruises, leaves, and other summer activities. The academic year gets underway. A long 4 years of study, hard study, lie ahead. Plebe Summer is over, but Plebe Indoctrination continues.

September also brings the excitement of football and other fall sports.

Midshipman Watchstanders in Bancroft Hall

Jack Engeman





Commandant and Plebes at Superintendent's Garden Party

During the football season, selected units of the Brigade travel to away games. The entire Brigade goes to home games, and to the Academy's favorite, the season-ending Army-Navy game.

Christmas brings a 2-week leave. This provides the first chance plebes have had to visit their homes since entry in June, as well as a welcome break in the academic routine for all midshipmen. Classes resume in early January, followed by semester-ending examinations late in the month. This is followed by a 3-day period of leave and the start of the second semester. A final 3 days of leave breaks the academic routine during the spring.

The Brigade Library

Jack Engeman





The End of Plebe Year

The approaching end of Plebe Year brings mixed emotions. A feeling of relief that it is almost over is surely one. At the same time there are well-deserved feelings of confidence and pride that the test has not proven too great. Mystery is turning to mastery.

Graduation is at one time both the high point and the ending of June Week. It is also the time decreed by tradition that the plebes must place a cap on the very top of the tall polished marble spire of the Herndon Monument. This they do with a vengeance. This sudden and spirited once-a-year activity at the monument is a memorable sight for startled spectators.

Third Class Year

With the placing of the cap, the intensive first year of indoctrination is ended, and the new Third Classmen get ready to depart on a 2-month summer cruise followed by 30 days of well-earned leave.

The cruise introduces the midshipman to navy life at sea. He meets and learns to respect the Navy's enlisted men upon whom he will later depend as an officer. He serves in many capacities and actively participates in a wide range of shipboard evolutions. He lives and works as an enlisted man performing routine ship's work; standing deck, gunnery, operations, and engineering watches; operating ship's boats; and exercising at general shipboard drills. He finds he must master the required practical factors for the basic enlisted rates of seaman and fireman. A highlight of the cruise is the chance to go ashore in foreign lands.

With the completion of cruise and summer leave, third classmen return to the Academy and begin their second academic year. Militarily, a third classman finds himself somewhat in between. He is too senior to be subject to plebe indoctrination and too junior to assist. Thus, although the new year brings him more responsibilities in infantry drills and watch standing, the lessened emphasis on indoctrination leaves him more time for sports and other extracurricular activities. It's a nice feeling.

Following the completion of academics for third class year and their second June Week, the third class become the new Second Class and begin another summer of interesting indoctrination and 30 days of leave.

Second Class Year

First, there is a short period of professional training at the Academy. Then, the class reports to naval air stations in Florida where they receive operational familiarization and actual flight instruction in the control of naval training aircraft.

As the midshipmen second class return to the Academy to begin their third academic year, still more military responsibilities are realized. Second Class midshipmen officers are selected and trained to direct the Brigade during periodic absences of the First Class. They are assigned more demanding watches. A few may be designated squad leaders and become involved in directing the military organization. An important part of the indoctrination of the new Fourth Class is assigned to the Second Class. In addition to contributing to the development of the Fourth Class, this responsibility contributes importantly to the Second Classman's growth as a leader. Finally, First Class year arrives.

First Class Year

During his last summer as a midshipman, the new midshipman First Class participates in his second afloat cruise. He stands the watches and performs the duties of a young naval officer and is exposed to the social courtesies, amenities, and customs of wardroom life aboard ship. Training programs consist of work in navigation; watch standing on the bridge and in Combat Information Center; and lectures and studies required to complete his *Cruise Journal*. In addition, he learns the duties of a junior engineering officer by standing watches throughout the engineering department and by exercising the responsibilities of an engineering division officer.

First Class cruises are usually made in foreign waters and thus midshipmen are able to visit many foreign ports.¹ After the cruise has ended, many First Class choose to remain in Europe or South America for their 30 days of leave before returning to the Naval Academy for the beginning of their final academic year. (This past summer, nine First Class students of Russian spent their leave in Russia.)

The important responsibility assigned the First Class for directing the Brigade has been noted. Midshipmen officers lead the Brigade in parades, ceremonies, and at daily formations. They are responsible for the conduct, military smartness, and competitive records of their units. They are in charge of the midshipman watch organization in Bancroft Hall. Selection of three sets of midshipmen officers during the year increases the individual opportunity for this valuable leadership experience. The third or final set of "stripers" is selected by the Commandant from the most capable midshipmen in the first two.

In attempting to carry out these demanding responsibilities, the First Class midshipman finds himself calling upon all the indoctrination and leadership principles he has accumulated during his first 3 years. Thus, following this final year of practical experience, graduation finds him well prepared to assume his leadership responsibilities in the Fleet as a newly commissioned officer.

Leave and Privileges

The amount of personal freedom and privilege granted a midshipman varies directly with his seniority and the degree of his authority and responsibility. A First Classman will not only have more responsibility in the administration of the Brigade but also more privileges.

¹ The 1964 cruises visited such places as Hawaii, the Philippines, Japan, and Hong Kong in the Pacific; Naples, Athens, Gibraltar, and Turkey in the Mediterranean; and Oslo, Portsmouth, Stockholm, Copenhagen, Hamburg, and Kiel in northern Europe.



Scenes From Summer Cruise





C. W. Wloszek



Formal Hops Are Always Popular

Midshipmen proficient in academic work and military aptitude also are rewarded with extra privileges.

There are several regular periods of leave of absence from the Academy for all classes during the year. These are Christmas leave, a period of about 2 weeks; end-of-term leave, a 3-day weekend break at the end of the first term in January; spring leave, a period of 3 days, usually in late March; and the month-long summer leave at the completion of the summer training program for the three upper classes.

In addition to leave of absence, midshipmen are granted liberty in the Annapolis area. Like all other privileges the amount varies with seniority and responsibility. Fourth Classmen are granted liberty on Saturday afternoons and dining-out privileges with relatives and close friends on Saturdays and Sundays. They are permitted to escort young ladies on three occasions and during June Week.

First, Second, and Third Class have liberty on Saturday afternoon and evening, and on Sunday afternoons. In addition, Second Class rate liberty on Wednesday afternoons and First Class rate liberty Friday evenings plus every afternoon. Weekday liberties begin after classes are completed for the day.

Limited numbers of weekend liberties are granted to upperclassmen. Midshipmen Third Class may take one weekend of leave each semester, Second Class midshipmen receive two each semester, and First Class receive four each semester. Additional weekends may be granted to outstanding midshipmen.

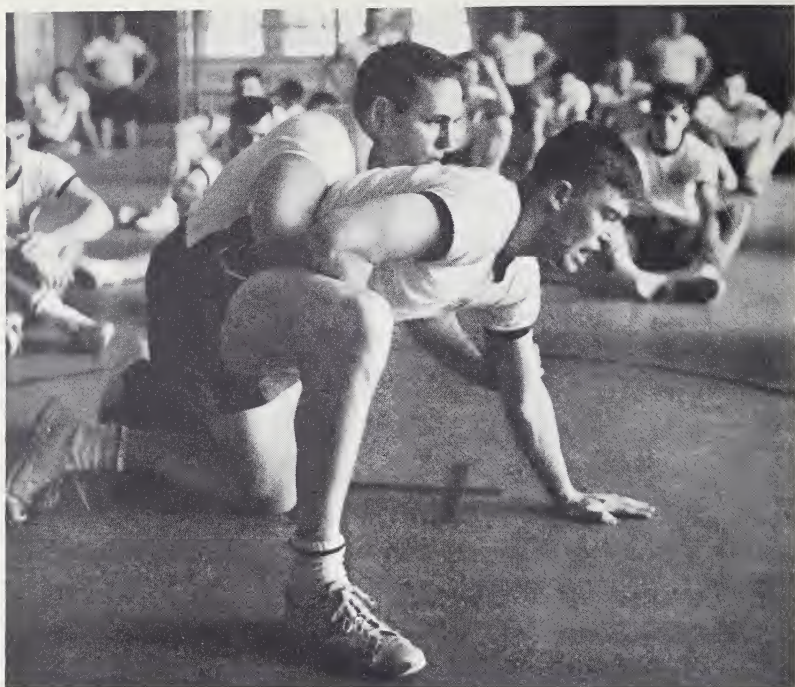
Physical Education

In supporting the Mission of the Naval Academy, the program of the Physical Education Department makes a vital contribution to the physical development of midshipmen. It continues throughout the 4 years. All midshipmen participate.

The program's aims for each midshipman are to develop skill, strength, confidence, teamwork, endurance, ability, and competitive spirit; to develop useful habits of physical fitness; to develop the capability to train and instruct others; and to develop the knowledge and capability to withstand physical hardship. Equally important, the program aims to be enjoyable, to provide a "release" from the academic routine, to develop a lasting appreciation for sports in general, and to develop individual skills in "carryover" sports for enjoyment after graduation.

Things get off to a fast start Plebe Summer. Preliminary testing of posture, swimming capability, and general athletic ability is followed by instruction and indoctrination drills in boxing, wrestling, lacrosse, fencing, soccer, gymnastics, crew, golf, tennis, squash racquets, volleyball, and track.

The pace continues during the first academic year. More advanced instruction is given in badminton, soccer, swimming, boxing, wrestling,

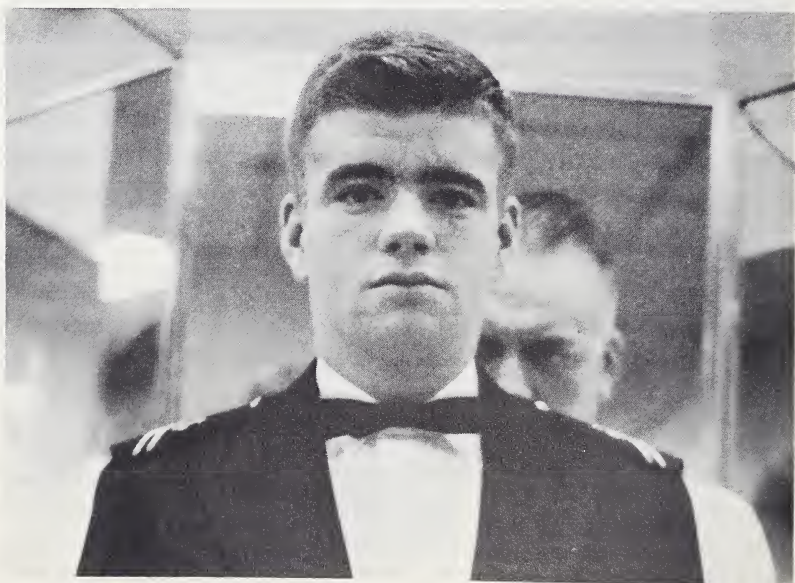


The Instructor Usually Wins

Jack Engeman

The Tailor's Experienced Eye

Jack Engeman





View of Midshipmen's Mess Hall

M. E. Warren

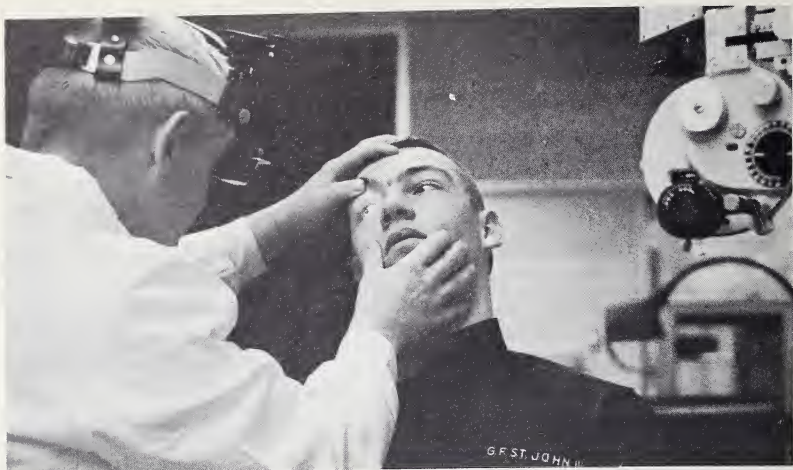
gymnastics, golf, tennis, and volleyball. In addition, midshipmen are introduced to basketball, handball, and bowling, and are tested in applied strength, agility, swimming, boxing, wrestling, and gymnastics.

The final three years follow up basic instruction and physical tests of the first year with increasingly advanced instruction and more demanding tests. Personal conditioning, athletic administration, and hand-to-hand combat are added to the area of instruction.

Naval Hygiene

Midshipmen are instructed in naval hygiene by medical and dental officers attached to Bancroft Hall. During Plebe Summer, Fourth Class are introduced briefly to the fundamentals of personal hygiene, including mental and physical hygiene and first aid. First Class instruction includes the human body as a functioning machine, care of the human machine, and the effect of various military environments.

The goal of this program is to insure that each midshipman has a thorough knowledge of the fundamental principles of hygiene, sanitation, and preventive medicine. This, plus the detailed knowledge gained of the human body and its functions, insures that the midshipman is prepared to carry out his future responsibilities for the health and welfare of himself and his men in differing military environments.



Jack Engeman

Bancroft Hall Medical and Dental Facilities

Medical and dental facilities in Bancroft Hall are extensive and up to date. Daily sick calls and periodic physical and dental examinations help keep the Brigade in excellent health. If hospitalization is necessary, there are the more-complete facilities of the U.S. Naval Hospital located at the Academy and the nearby U.S. Naval Hospital at the world-famous National Naval Medical Center in Bethesda, Md.

Bancroft Hall Service Facilities

All of the basic facilities needed for daily living and many for recreation are found in Bancroft Hall. Press shops provide rapid service on midshipman uniforms which the tailor shops keep fitted and repaired. Barbershops manage nearly 4,000 haircuts every week. The Midshipmen's Store provides daily necessities and the place to buy an occasional gift. There are Chaplains' offices with small adjoining Protestant and Catholic Chapels.

The galleys produce about 12,000 freshly prepared meals daily, providing each midshipman with 4,000 calories. Meals are served in the midshipman messhall, believed the world's largest indoor dining area, covering 65,000 square feet and seating the entire Brigade at one time.

Laundry and drycleaning services are provided. There is a cobbler shop, a post office, a library, an assembly hall, a bookstore, and the midshipmen's radio station. For recreation, there are bowling alleys, squash courts, a recreation room, clubrooms, a photo laboratory, and a band room. And there is a language laboratory. On weekends Memorial Hall and Smoke Hall are used for dances, and the Steerage, or soda fountain, serves as an area where midshipmen may relax with their dates.



Jack Engeman

Superintendent and Commandant Congratulate
Team Captain of Navy's 1964 National Soccer Champions

THE ATHLETIC PROGRAM

The Academy's broad intramural and varsity athletic programs strongly complement the physical education program in accomplishing the Academy's mission for the physical development of midshipmen. Believed to be the largest athletic program of its type in the Nation, it includes varsity squads in 21 different sports and intramural sports competition in 24 separate areas.

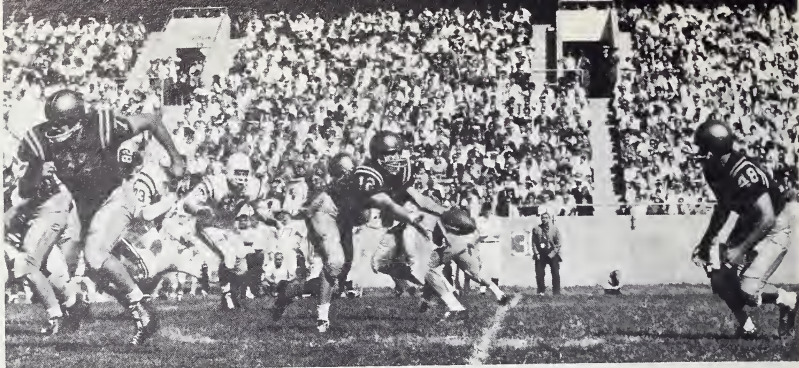
The activity sprawls over 101 acres of lighted playing fields; spills onto the gridiron of the Academy's modern, 29,000-seat Navy-Marine Corps Memorial Stadium; echoes through the cavernous Field House; fills a vast array of tennis, squash, handball, and badminton courts; and enlivens wrestling mats, boxing rings, and swimming pools.

A knowledgeable staff of coaches and a veteran team of athletic administrators insure a smoothly functioning program.

Intercollegiate Athletics

Navy squads meet topflight competition in 21 varsity sports from football to fencing, swimming to sailing, and soccer to squash.

During the athletic year 1963-64, Navy's varsity teams won an im-



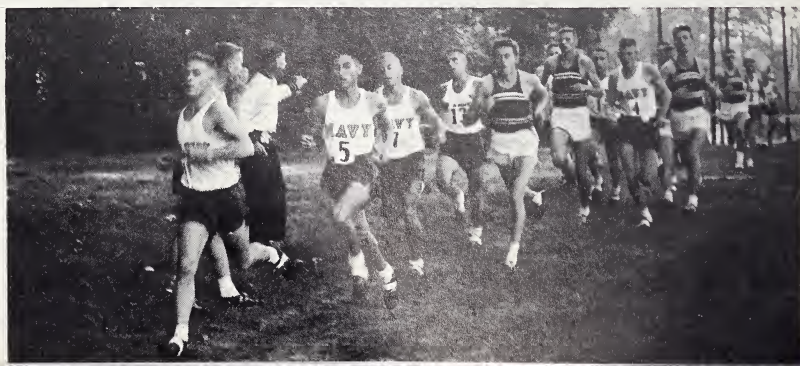
pressive 70 percent of their engagements. The overall record was 141 victories, 59 losses, and 1 tie.

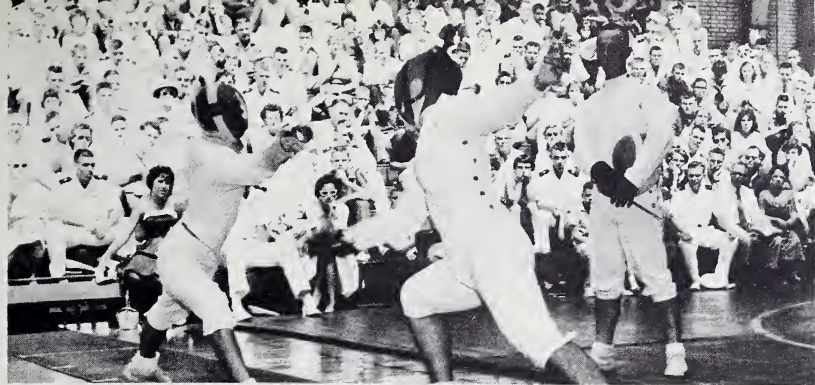
The midshipmen captured their fifth consecutive national cham-



pionship in lacrosse and added Eastern titles in three other sports. Ten Navy representatives in seven different sports achieved first-team All-American status.

Intercollegiate competition is conducted in the following sports: Baseball, basketball, crew (heavyweight and lightweight), cross country, fencing, football (varsity and lightweight), golf, gymnastics, lacrosse, pistol, rifle, sailing, soccer, squash, swimming, tennis, track (indoor and outdoor), and wrestling.





Fall Sports

Navy football is familiar to gridiron fans across the Nation. The



Jack Engeman



Roger Staubachs, Joe Bellinos, Slade Cutters, and other great Navy players have spread the Academy's pigskin image to living rooms in every corner of the land.

The midshipmen meet such highly regarded football powerhouses as Notre Dame, Georgia Tech, Penn State, Pitt, and Army during a 10-game season that takes Navy into stadiums from Philadelphia to San Francisco.







Football, however, is not restricted to a varsity level. Spots are also open on Navy's lightweight team, a perennial contender for the Eastern championship; the junior varsity squad; or the plebe eleven.

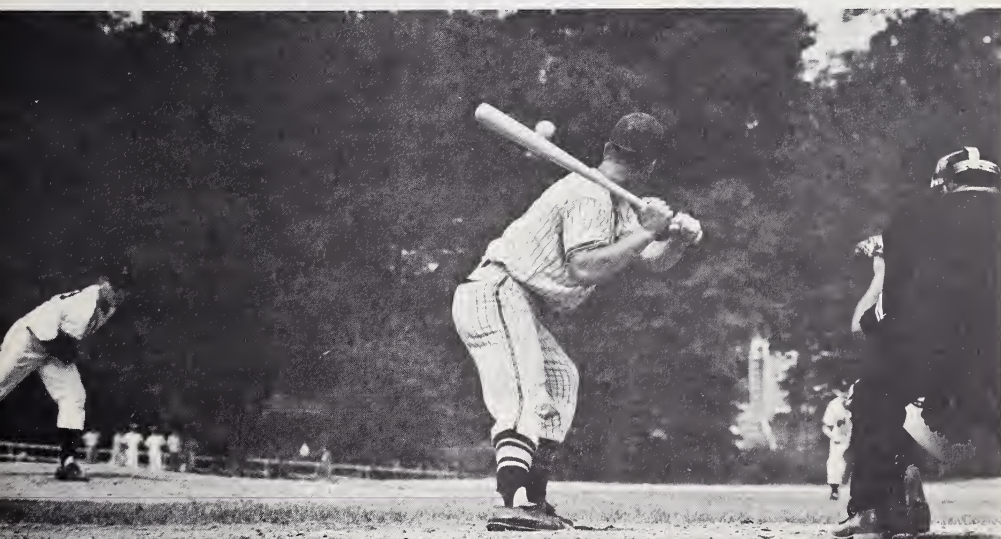
Cross country and soccer share the autumn spotlight with football. The 1964 Navy harriers won the Eastern Heptagonal championship over a grueling 5-mile course. Navy's soccer team won the National Collegiate Athletic Association championship in 1964 and finished with a perfect 15-0 season.

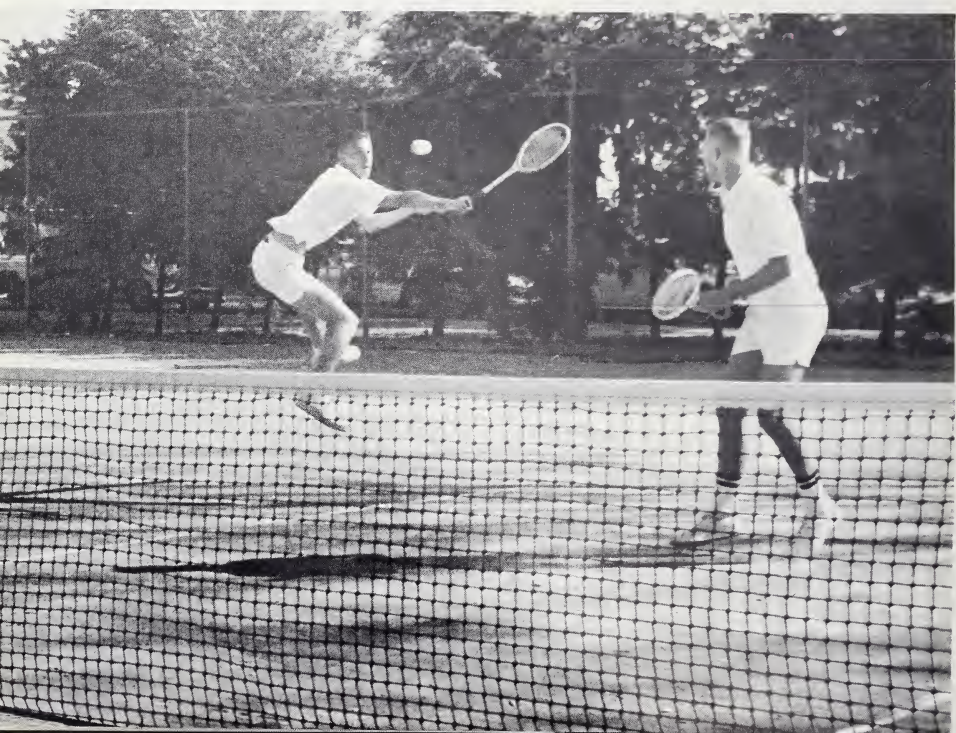
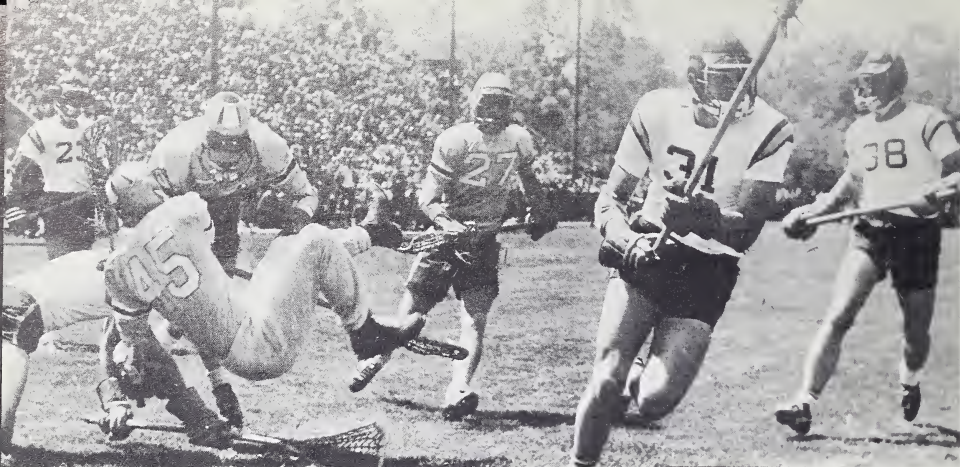
Skipjack sailing spills into both the fall and spring seasons. The sailors are active in the Middle Atlantic Intercollegiate Sailing Association.

Winter Sports

From swimming pool to wrestling loft, midshipmen are busy in nine sports during winter months.

Navy basketball teams have enjoyed great success since the sport was added to the intercollegiate program in 1906. The midshipmen have had only three losing seasons in that time and have been invited to participate in numerous postseason tournaments.



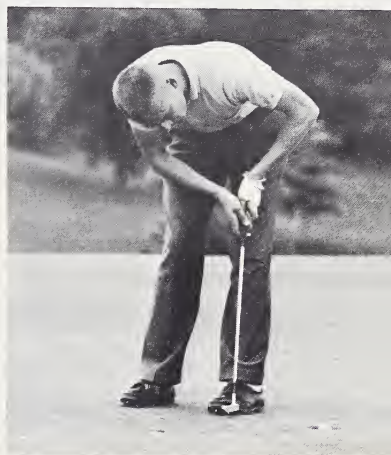


The Navy fencing team has won two National crowns and one Eastern title during the past 5 years.

Skilled performers may also bid for berths on the gymnastics, rifle, pistol, squash, swimming, track, and wrestling teams. Rifle and pistol facilities include the most modern galleries at any institution. The Academy Natatorium, site of Navy's home swimming meets, includes seating for a large gallery of spectators. One of the finest indoor tracks in the East is a prominent feature of the physical plant.

Spring Sports

Olympic, National, or Eastern championships are nothing new for Navy's springtime athletic squads. In recent years, the midshipmen



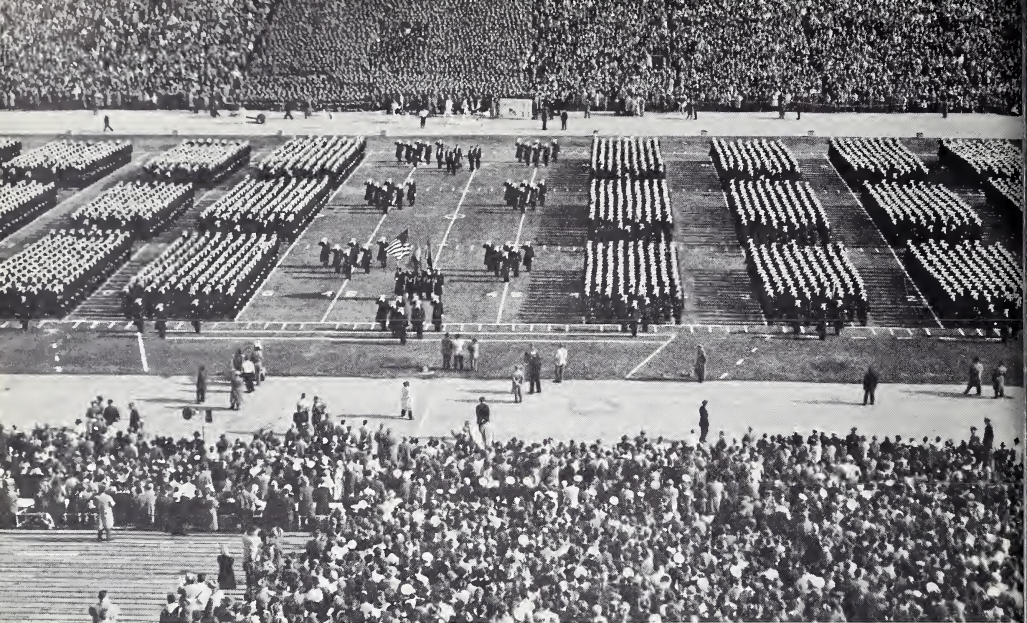
have held these titles in crew, lacrosse, and baseball, respectively.

Navy's ambitious rowing program includes three shells—varsity, junior varsity, and plebe—in both a heavyweight and a lightweight program. Navy's crew last competed in the Olympic games in 1960. The midshipmen were gold medal winners for the United States in the 1952 Olympics. Navy shells swept the N.C.A.A.'s in 1965.

Baseball is played in 5,000-seat Lawrence Field, one of the finest collegiate baseball facilities in the land. Navy competes in the Eastern Intercollegiate Baseball League, which includes the Ivy League schools in addition to Army and Navy.

A highly popular spring sport is lacrosse, which takes its roots from the rugged game played by the American Indians. Navy has won six consecutive National lacrosse championships!

Golf and tennis are recreational pursuits that can be followed in the years after graduation. The Academy boasts a beautiful and challenging 6,217-yard golf course and blocks of tennis courts. Outdoor track and sailing complete the roster of spring sports.



Army-Navy Game

Naval Academy Athletic Association

The Naval Academy Athletic Association is a non-profit organization charged by the Superintendent with the responsibility for providing and administering the intercollegiate sports program for the Midshipmen. It is headquartered at the Naval Academy. The Association discharges its responsibility without the use of appropriated funds.

The Association arranges the varsity schedules, provides able coaching staffs and necessary equipment, and maintains a central office to handle the administrative details of the athletic program.

The Naval Academy, a member of the Eastern College Athletic Conference (ECAC) and the National Collegiate Athletic Association (NCAA), is represented in and conforms to their regulations concerning Amateur Athletes through the offices of the Naval Academy Athletic Association.





Has Anyone Seen the Goal Line?

Intramural Sports

Midshipmen not on varsity teams are required to take part in intramural sports. Thus every midshipman is able to benefit from experience in competitive team sports at a level appropriate to his skill.

Intramural competition is organized at the battalion and company level. Trophies are awarded championship teams. Intramural sports include:

Badminton	Football	Swimming
Basketball	Gymnastics	Tennis
Boxing	Handball	Touch football
Bowling	Lacrosse	Track
Crew	Rugby	Triathlon
Cross country	Soccer	Volley ball
Fencing	Softball	Water polo
Field ball	Squash	Wrestling





Debaters Receiving 1964 Award for Fourth Best in Nation

THE EXTRACURRICULAR PROGRAM

Life at the Academy offers midshipmen a varied and wide-ranging choice of extracurricular activities. Musically there are the Antiphonal Choir; the Protestant Choir; the Catholic Choir; the Glee Club; the Drum and Bugle Corps; the Concert Band; the midshipmen's ever-popular jazz and dance band, the NA-10; and the Spiffies for rhythm and blues, rock-and-roll, and the latest in twist and surfer music.

For those with a literary or journalistic bent, publications are numer-

Midshipman Publications



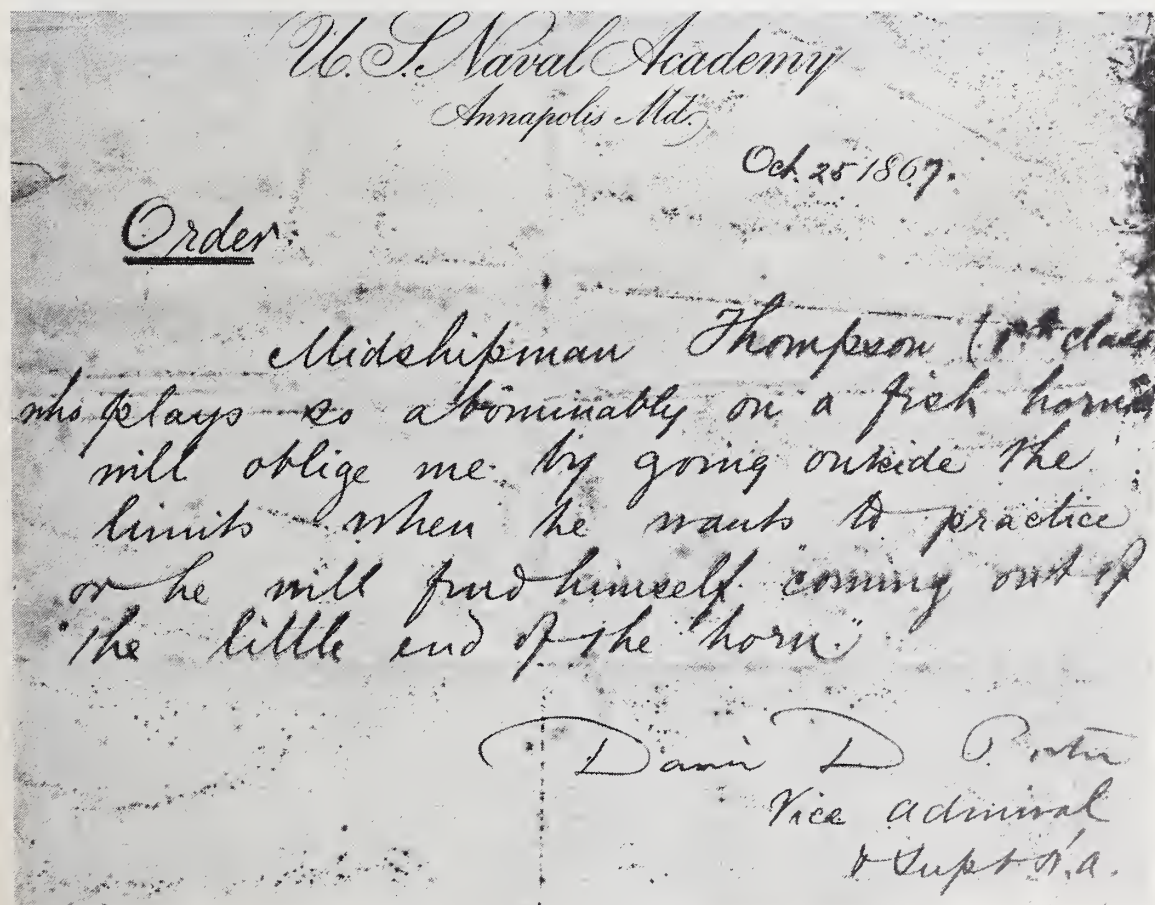
ous and varied. There is the *Lucky Bag*, the yearbook for each class. There is the literary and artistic *Trident Magazine*; the less serious and more typical campus magazine, *The Log*; and its sports-minded offspring *The Splinter*. There is also the *Trident Calendar*, embellished by photographs and cartoons. And, finally, there is *Reef Points*, a guide to Academy and Navy organization, lore, and customs for the incoming plebes.

Dramatic activity includes the Masqueraders, the Stage Gang, the Property and Make-up Gang, the Juice (electrical) Gang, and the Musical Clubs Show.

Club activity includes the Photographic Club; the Chess Club; the Art and Printing Club; the Radio (ham) Club; the Scuba Club; the Varsity "N" Club; the Foreign Languages Club, with separate branches in each of six different languages; and the Foreign Relations Club, well known throughout intercollegiate circles for its role in planning and conducting the annual Naval Academy Foreign Affairs Conference (NAFAC).

There are numerous Class organizations and officers. Though they by no means complete the listing of extracurricular activities, there are the debaters and the midshipmen's radio station WRNV. The Academy's professionally oriented extracurricular sailing and YI Squadron programs are discussed separately and in some detail on succeeding pages.

A Former Superintendent Shows An Early Interest in Extracurricular Activities



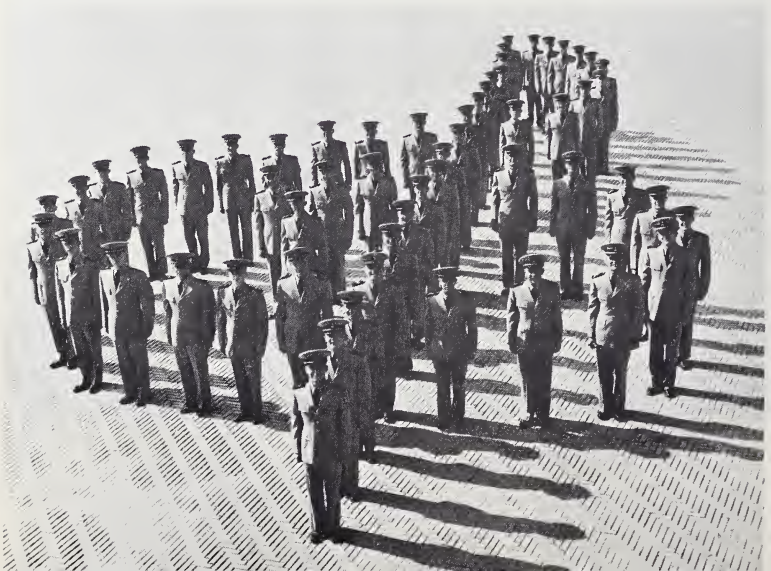


Concert Band



The Drum and Bugle Corps

The Glee Club



Dramatic Society



June Week Dance by Reflecting Pool

Midshipman Radio Station





Luders Yawl—A Bright Day with Spinnaker Flying

SAILING

Sailing at the Academy has a serious professional purpose. It is also fun.

Skills and knowledge of seamanship and the sea gained under sail are the same basic skills and knowledge used by seamen for centuries. They are as relevant in bringing a ship safely home to port today as they ever were. Thus, by developing better seamen, the Academy's sailing program contributes materially to the development of better naval officers.

Sailing is easily the most popular extracurricular activity at the Academy, with almost 1,000 midshipmen engaged in competitive or recreational sailing. And, judging by the look of things along the seawall on weekends, sailing is equally popular with drags (dates).



Robert de Gast

The Academy has one of the finest small craft facilities in the world as well as some of the best known boats in ocean-racing circles. The sailing fleet ranges from the 88-foot schooner *Freedom* through the 50-foot yawls *Annie D* and *Gypsy* to unsinkable two-man Skipjacks. The Academy's 71-foot yawl *Royono* was first to cross the line in the 1952 Newport-Bermuda race, and its recently retired 62-foot cutter *Highland Light* was holder of the record for elapsed time in that ocean-racing classic for 22 years.

During Plebe Summer, midshipmen receive basic training in sail in the Academy's fleet of thirty 26-foot knockabouts and twelve 44-foot Luders yawls. After Plebe Summer all sailing is voluntary.

Twenty-six Skipjacks and five Shields sloops are used for advanced training and intramural and intercollegiate competition. Other com-



Knockabouts

petitive experience during the academic year includes open competition in Chesapeake Bay aboard the 30-foot Shields sloops, the 44-foot Luders yawls, and aboard the larger yachts. During the summer the larger yachts are sailed in the open sea in the Bermuda and Annapolis-Newport ocean races.

Intercollegiate sailing is conducted by the Physical Education Department. Other sailing beyond the primary stage is administered by the Naval Academy Sailing Squadron, an organization of officers, faculty, and other devotees of sailing. Besides being highly popular, Squadron-arranged weekend sailing trips give midshipmen a chance to carry the spirit of the Navy to other ports.



M. E. Warren



THE YP SQUADRON

The Naval Academy YP Squadron is organized for midshipmen who desire more extensive training afloat than is offered by summer cruises and the Naval Science Department's curriculum. The Squadron consists of seven Yard Patrol craft assigned one to each of the six battalions, with the seventh assigned as flagship of the entire Squadron.

The organization and practices of the YP Squadron are very similar to those of Fleet destroyer squadrons on duty around the world. The "officers" are midshipmen first class selected annually in recognition of their ability to fulfill command positions. The Squadron Comodore is responsible for the overall performance and excellence of the Squadron, including the coordination of training, proficiency competition, inspections, and cruises. Assisting him are a Chief Staff Officer, two Division Commanders, and an Administration Officer. Completing the staff is an Engineering Officer who supervises training in engineering and insures that engineering equipment is operated and maintained properly. Each Yard Patrol craft is commanded by a First Classman who is assisted by a 20-man crew composed of midshipmen from all classes.

Training is serious business during the week. Crews get underway on Tuesday, Thursday, and Friday afternoons. Mondays and Wednesdays are reserved for classroom drills and instruction. In addition to daily training sessions, weekend cruises are conducted to Washington, D.C., Norfolk, Va., Philadelphia, and to various Chesapeake Bay ports.

Competition between YP's for the "Battle Efficiency Pennant" is keen. The crew adjudged most proficient overall in tactics, deck seamanship, piloting, communications, and engineering is declared the winner.



Research in Brigade Library, Bancroft Hall

THE LIBRARY

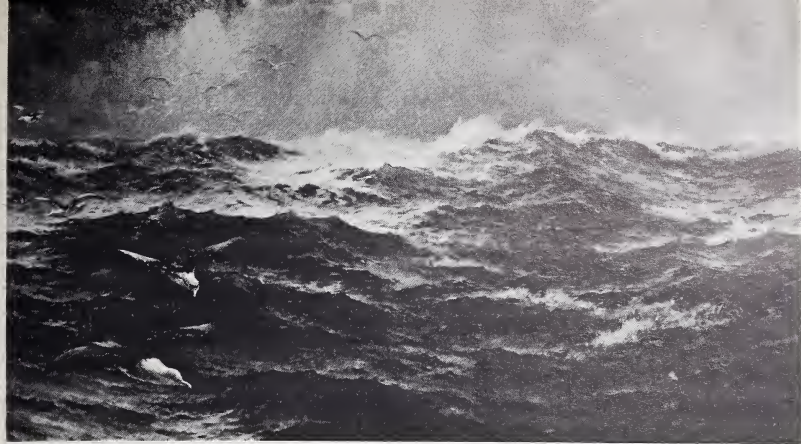
The Naval Academy Library, under the direction of a professional librarian, provides broad support to the academic program. In addition to support in depth for the Academy's scientifically oriented curriculum, the Library includes strong sections of basic works of reference, and periodicals and source materials in history and literature and in the humanities generally. The Library is especially rich in military source materials and has assembled one of the largest collections of naval books in the United States.

Midshipmen make extensive use of the Library for study and research and for recreation. Convenient facilities for the use of microfilm and other miniaturized textual reproductions for reference are available. The Mail Library is located in Mahan Hall, with a nearby Annex for Government documents, back files, and related titles.

The Brigade Library, located within Bancroft Hall, is a recent and handsome addition to Academy library facilities. Open nightly until midnight, it contains a selected collection of books and magazines, reserved shelves of books specified by instructors for collateral use in connection with regular and elective courses, excellent taping and playback equipment for recorded sound and music, and extensive display cases for special exhibits.

The Main Reading Room of the Naval Academy Library





The Ocean—Highway of All Nations, by Edward Moran

THE MUSEUM

The Naval Academy Museum serves as inspiration to the men of the Brigade by providing tangible evidence of some of the most glorious episodes in the Nation's history. Its collection of more than 50,000 individual items also provides an important reference source for the teaching of naval history.

While most of the Museum's valuable collections are located within the Museum, other items of exceptional interest and value are located in the Chapel, Memorial Hall, the Library, and in other buildings throughout the Academy. The Museum contains some of the finest ship models in the world, including many from the famous Rogers Collection; a superb collection of 13 maritime paintings by Edward Moran; perhaps the largest collection in the world of items relating to the life and work of John Paul Jones; the table from the mess deck of the battleship *Missouri* on which was signed the instrument of surrender ending World War II; and literally thousands of other significant items relating to the history of our Navy and of the Naval Academy. In addition, the Museum has valuable collections of manuscripts and extensive photographic files.

Museum items in Bancroft Hall include the flag hoisted by Commodore Oliver Hazard Perry at the Battle of Lake Erie on which were emblazoned the immortal words of the dying James Lawrence, "Don't Give Up The Ship!"; the original marble bust of John Paul Jones by Jean Antonine Haudon; and fine portraits of distinguished naval officers. In the Chapel Crypt will be found John Paul Jones' commission as a captain, signed by John Hancock; his membership certificate in the Society of the Cincinnati, signed by George Washington; and the dress sword presented to him by King Louis XVI. The Library contains a number of ship models from the Rogers Collection, and numerous historic flags, including the only known captured British Royal Standard.



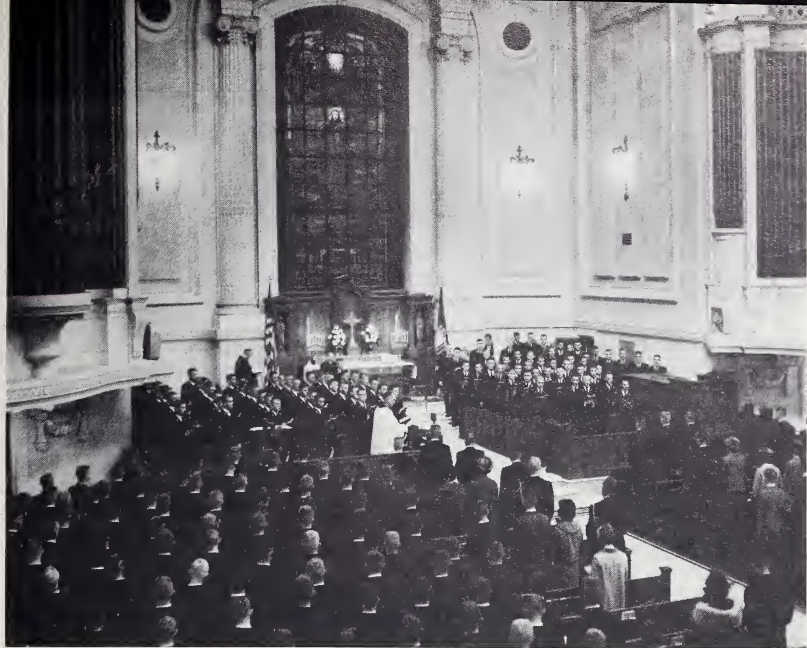
RELIGIOUS ACTIVITIES

It is no mere coincidence that the beautiful dome of the Chapel at the U.S. Naval Academy rises above, and dominates, all other buildings in the Yard. Nor is it by chance that the Chapel was placed centrally in planning the buildings as they now stand. This is fitting, since our country was founded on religious principles cherished by all faiths, which are the foundations of our ideals of freedom and responsibility.

The present Chapel was completed in 1908. An addition was dedicated in 1940, increasing the seating capacity to 2,500 and changing the basic design of the Chapel from that of the Greek Cross to that of the Roman Cross. The much smaller St. Andrew's Chapel is located directly beneath the Main Chapel.

Because we are "One nation, under God," it is most appropriate that the midshipmen who will some day become the leaders of our Navy should regularly attend Divine Worship Services. Thus, all midshipmen of the Roman Catholic faith attend Mass in the Chapel. Midshipmen of the various Protestant denominations attend the Protestant Chapel Service or the church of their choice in the city of Annapolis. Midshipmen of the Jewish and Greek Orthodox faiths attend synagogue or church in Annapolis.

During the half hour preceding the 10:30 Morning Worship, the Naval Academy Band gives a concert in front of the Chapel. As time for services draws near, the Brigade of Midshipmen march to Chapel to the music of the band, to be greeted and reviewed by the Superintendent and his official party on the Chapel steps.



The services, both Catholic and Protestant, are enhanced by the stately beauty of the Chapel. The Protestant worship service is interdenominational, having gradually evolved from the time of the Academy's founding into its present form.

Both services begin with the parading of the Ensign and the Brigade flag to the altar where they are dipped to the Cross, signifying our allegiance to God. This is followed by the choir marching to the chancel.

In the Protestant service the Chapel Choir is joined by the Antiphonal Choir in the balcony. These combined choirs number approximately 250 midshipmen. The prayers, responses, and creeds are those used by Christians through the ages, but there are special Navy and Naval

Communion Services in St. Andrew's Chapel



Academy prayers including the following Midshipman's Prayer:

Almighty Father, whose way is in the sea, whose paths are in the great waters, whose command is over all and whose love never faileth: Let me be aware of Thy presence and obedient to Thy will. Keep me true to my best self, guarding me against dishonesty in purpose and in deed, and helping me so to live that I can stand unashamed and unafraid before my shipmates, my loved ones, and Thee. Protect those in whose love I live. Give me the will to do the work of a man and to accept my share of responsibilities with a strong heart and a cheerful mind. Make me considerate of those intrusted to my leadership and faithful to the duties my country has intrusted in me. Let my uniform remind me daily of the traditions of the Service of which I am a part. If I am inclined to doubt, steady my faith; if I am tempted, make me strong to resist; if I should miss the mark, give me courage to try again. Guide me with the light of truth and keep before me the life of Him by whose example and help I trust to obtain the answer to my prayer Jesus Christ our Lord. Amen.

Sunday Catholic Mass is said in the Main Chapel at 8 a.m., with High Mass on the first Sunday of every month. A choir of approximately 125 midshipmen sings at the Sunday Mass.

Protestant Holy Communion services are held periodically during the week at 6 a.m. and Sunday morning at 9 a.m. in St. Andrew's Chapel. At 5:30 p.m. on Sunday evenings, a brief informal service is conducted with midshipmen participating. The Naval Academy Christian Association meets on the first and third Sunday evenings of the month in Bancroft Hall. A Sunday school for children of civilian and military personnel is taught by midshipmen. At Christmas time the Protestant Choir is joined by the Hood College Girls' Choir and professional soloists in presenting Handel's "Messiah."

For Catholic midshipmen, Mass is said daily in St. Andrew's Chapel, Monday through Saturday. Confessions are heard daily before Mass and on Saturday afternoon and evening. The Newman Club meets on the second and fourth Sundays to discuss various dogmas of faith and aspects of the Church in the modern world. Guest speakers are featured. An annual Lay Retreat is sponsored by the club.

Protestant and Catholic services are held each Sunday at the Naval Academy Hospital, and periodic visits are made to the patients.

Chaplains are always available for counseling at their offices in the Chapel and at Bancroft Hall. They welcome the opportunity to meet with parents and join them in the hope that the faith of their son will grow and flourish during his time as a midshipman at the Naval Academy.



DESCRIPTION OF ACADEMIC COURSES

The following course descriptions are grouped by academic departments. They are preceded by a listing of the faculty and a description of the mission, facilities, and programs of each department. Courses are represented by a letter prefix followed by a three-digit number. The letter prefix identifies the department offering the course. All core courses begin with number 1, 2, 3, or 4. With minor exceptions, the first digit of a core course indicates the year offered; i.e., 1 the first (fourth class) year, 2 the second year, etc. Electives may begin with any number from 1 through 9. Seminar and research-type courses begin with a "9." Letter suffixes used with foreign language courses are self-explanatory.

Engineering Department

Head of Department: Captain Wayne Hoof; **Executive Officer:** Commander W. J. Francy; **Senior Professor:** A. E. Bock; **Professors:** R. M. Johnston, R. D. Mathieu; **Commanders:** J. W. Beeler, J. J. Branson, Jr., C. O. Brown, D. G. Faulkner, W. J. Francy, H. L. Hussmann III, C. F. Martin, R. S. Moore, L. M. Ramsey, H. K. Richards, Jr., T. H. Ross, F. P. Schlosser, N. R. Thom, R. J. Trott, H. L. Smith, J. R. Wilkins, R. T. Wurzbacher, S. T. Zinc; **Associate Professors:** A-M Alwan, W. A. Barr, W. J. Battin, H. C. DeMart, E. E. Dodson, W. F. Eckley, W. H. Geatches, T. C. Gillmer, R. A. Granger II, B. Johnson, R. F. Latham, W. M. Lee, V. J. Lopardo, J. E. Losure, A. A. Pouring, B. H. Rankin, F. L. Smith, Jr., J. H. Smith, V. V. Utgoff; **Lieutenant Commanders/Majors, USMC:** E. M. Avallone, E. C. Bauer, R. I. Comstock, R. R. Cornwell, G. T. Dyer, T. O. Gregory (USA), J. D. Kertz, K. Nelson, R. C. Rowley, R. H. Sullivan; **Assistant Professors:** L. M. Billow, T. D. Clark, Jr., R. T. Driftmyer, R. K. Frahm, J. O. Geremia, C. O. Heller, E. G. Hieber, W. B. Huckenpoehler, Jr., H. H. Keith, Jr., T. Kowalski, B. J. Luteranik, W. W. Pulkrabek, K. F. Read, D. F. Rogers, G. H. Schlimm, W. H. Schulden, E. O. Seaquist, Jr., P. F. Wiggins; **Lieutenants/Captains, USMC:** R. C. Casey, R. W. Clark, R. P. Dunbar, C. R. Franklin, M. R. Gluse, J. P. Gorzelanski, H. D. Griffin, L. G. Hyatt, P. Y. Jackson, R. D. Kemper, C. J. King, Jr., B. R. Laub, R. J. Levensdoski, R. B. McPherson, R. H. Oates, H. H. Page, Jr., H. J. Strachwitz, G. D. Veasey; **Lieutenants (jg):** V. D. Dryden, F. S. Hering; **Ensigns:** W. F. Marks II.

Mission

The mission of this department is to provide midshipmen with a course of study designed to give them an understanding of basic engineering concepts, to teach them to approach problems in an orderly and analytical manner, and to develop naval officers who will use this knowledge as a basis for sound professional judgment and decisions. It is the objective of this department to furnish the basic engineering knowledge required of all midshipmen to complete a successful naval career, and also provide the opportunity for interested midshipmen to pursue additional studies in the fields of Aerospace and Mechanical and Naval Engineering. Five core courses and 36 elective courses are offered in support of the departmental mission. Midshipmen are introduced to the practical application of engineering during summer cruises.

Facilities

The offices, classrooms, laboratories, shops, and other facilities of the Engineering Department are housed in the three-building complex composed of Isherwood, Griffin, and Melville Halls. Teaching facilities of this department, other than classrooms, include: 5 drawing rooms with a total capacity of 1,276 (including 1 drawing room that is divided to provide ten 30-man semiprivate classrooms); and 4 lecture rooms with a total capacity of 472.

The Engineering Department utilizes the following seven laboratories for academic exercises and demonstrations:

Engineering Materials Testing Laboratory. Six identical laboratory cells are designed and equipped to accommodate up to 20 students per cell. Tests of engineering materials are performed, including tension, compression, torsion, beam flexure, beam deflection, column buckling, hardness, and impact. Equipment is also available for heat treating metals, metallography work, and other metallurgical tests.

Wind Tunnel. The closed-circuit, subsonic wind tunnel is powered by a constant speed electric motor geared to a modified, variable-pitch aircraft propeller. It is equipped with a pyramidal strut-type electric beam balance system.

The maximum velocity through the 2½' x 3½' test section is 225 miles per hour. The laboratory includes a 77-seat amphitheater where students may observe demonstrations and tests.

Nucleonics Laboratory. The nucleonics laboratory consists of a subcritical reactor with 2,500 kg of natural uranium surrounded by light water and excited by a neutron source of 5 curies of plutonium-beryllium. The uranium and Pu-Be are leased from the Atomic Energy Commission. Additional laboratory equipment, such as radiation detection devices, counters, computers, and safety equipment, is also available.

Fluid Mechanics Laboratory. This laboratory is equipped to demonstrate basic principles involved in fluid friction, flow metering devices, turbomachinery, and the flow of compressible fluids. Equipment is also available to conduct exercises involving motor driven centrifugal pumps, open-end subsonic wind tunnels and nozzles, and apparatus instrumented to determine head loss in pipes and valves as well as the characteristics of various flow meters.

Internal Combustion Engine Laboratory. The laboratory facility includes 5 test cells capable of handling 15–20 students each, with associated engine equipment including cooperative fuel research engines, small General Motors diesel engines, 4-stroke cycle commercial gasoline engines, and small and medium-sized gas turbines. One test cell is provided with a soundproofed amphitheater for demonstration to up to 75 students. A sixth test cell is available with services and test stand for special experimentation.

Ship Hydromechanics Laboratory. The *ship model towing tank* is 85' x 6' x 4', of steel construction, and equipped with both powered carriage and gravity drive mechanism. The powered carriage drive is capable of speeds to 20 feet per second and carries a dynamometer to measure hydrodynamic forces exerted on the towed model. All instrument systems read out to the control end of the tank, with speeds both visually and graphically recorded in knots to three decimals and dynamometer forces in pounds (visually) to three decimals. A wave generator is installed which produces a unidirectional wave whose height and length may be separately controlled. Waves up to 6 inches in height and 5.5 feet in length may be generated.

A *stability tank* 18' x 22' x 4' is installed for ship stability analysis of models to 20 feet in length and with displacements up to 2,000 pounds. A *circulating water channel* is available for research and instruction. This is a test device used for solving complex problems concerning flow around submerged and surface piercing bodies. The water is circulated by a pump, permitting a model to remain stationary, while observing flow conditions.

Thermodynamics Laboratory. This laboratory consists of five steam-driven, 60-kilowatt *turbogenerator sets* complete with condensers and necessary auxiliary equipment. All components are instrumented so that heat balances, efficiencies, and complete performance curves can be developed for each piece of equipment. This laboratory also includes the following pieces of equipment: three two-stage, water-cooled *air compressors* for cycle studies, pressure-volume studies, and efficiency measurements; two 6.2-ton Freon *air-conditioning/refrigerating units* for heat exchange rate experiments, cycle studies, and efficiency studies; and one concentric ring *heat exchanger* for the conduct of heat transfer experiments under conditions of parallel and counter flow.

In addition to the laboratories described above, the Engineering Department maintains a completely equipped patternmaking and carpenter shop, a machine shop, a foundry, and a sheet metal shop. These shops are manned by approximately 25 skilled civilian employees.

Two *model rooms* display cutaways of current ships, powerplants, and ship-board equipment, as well as models of ships and powerplants of historical interest.

Core Courses

- E207 Solid Mechanics*
- E208 Engineering Materials
- E300 Ship Hydrostatics (Buoyancy and Stability)
- E311 Elements of Thermodynamics
- E312 Elements of Fluid Mechanics

*Midshipmen enrolled in Engineering Department Programs will take E211 vice E207.

Minors Program

Aerospace Engineering

- E206 Engineering Materials (in lieu of E208)
- E305 Thermodynamics I (in lieu of E311)
- E306 Fluid Mechanics I (in lieu of E312)
- E605 Strength of Materials
- E631 Introduction to Aerodynamics
- E731 Aero Structures I
- E734 Aero Performance
- E... Aero Flective
- E835 Stability and Control

Mechanical Engineering

- E206 Engineering Materials (in lieu of E208)
- E305 Thermodynamics I (in lieu of E311)
- E306 Fluid Mechanics I (in lieu of E312)
- E407 Fluid Mechanics II
- E408 Thermodynamics II
- E601 Kinematics
- E604 Intermediate Strength of Materials
- E605 Strength of Materials
- E701 Physical Metallurgy

Naval Engineering (Naval Architecture Option)

- E206 Engineering Materials (in lieu of E208)
- E305 Thermodynamics I (in lieu of E311)
- E306 Fluid Mechanics I (in lieu of E312)
- E407 Fluid Mechanics II
- E408 Thermodynamics II
- E605 Strength of Materials
- E801 Naval Architecture I—Hydrostatics
- E802 Naval Architecture II—Hydrodynamics
- E811 Ship Structures

Naval Engineering (Ship Propulsion Option)

- E206 Engineering Materials (in lieu of E208)
- E305 Thermodynamics I (in lieu of E311)
- E306 Fluid Mechanics I (in lieu of E312)
- E407 Fluid Mechanics II
- E408 Thermodynamics II
- E605 Strength of Materials
- E708 Heat Transfer I
- E709 Reactor Physics I
- E710 Reactor Physics II

Majors Program

Aerospace Engineering

E206	Engineering Materials (in lieu of E208)	E731	Aero Structures I
E305	Thermodynamics I (in lieu of E311)	E732	Aerodynamics I (in lieu of E312)
W410	Automatic Control Systems	E734	Aero Performance
E605	Strength of Materials	E807	Gas Power Propulsion I
E631	Introduction to Aerodynamics	E808	Gas Power Propulsion II
M704	Math for Engineers and Physicists	E809	Mechanical Vibrations
		E832	Aero Structures II
		E835	Stability and Control

Plus two of the following courses:

E708	Heat Transfer I	E836	Aero Design
E831	Aerodynamics II	E902	Research Project
E834	Orbital Mechanics		

Mechanical Engineering

E206	Engineering Materials (in lieu of E208)
E305	Thermodynamics I (in lieu of E311)
E306	Fluid Mechanics I (in lieu of E312)
E407	Fluid Mechanics II
E408	Thermodynamics II
W410	Automatic Control Systems
E601	Kinematics
E604	Intermediate Strength of Materials
E605	Strength of Materials
E701	Physical Metallurgy
M704	Math for Engineers and Physicists
E708	Heat Transfer I
E809	Mechanical Vibrations

Plus three of the following courses:

E606	Theory of Engineering Experimentation
E608	Engineering Graphics II
E707	Machine Design
E709	Reactor Physics I
E710	Reactor Physics II
E744	Mechanical Behavior of Materials
E813	Continuum Mechanics
E902	Research Project

Naval Engineering

E206	Engineering Materials (in lieu of E208)
E305	Thermodynamics I (in lieu of E311)
E306	Fluid Mechanics I (in lieu of E312)
E407	Fluid Mechanics II
E408	Thermodynamics II
W410	Automatic Control Systems
E605	Strength of Materials
M704	Math for Engineers and Physicists
E708	Heat Transfer I
E709	Reactor Physics I
E710	Reactor Physics II
E801	Naval Architecture I—Hydrostatics
E802	Naval Architecture II—Hydrodynamics
E809	Mechanical Vibrations
E811	Ship's Structures

Plus one of the following courses:

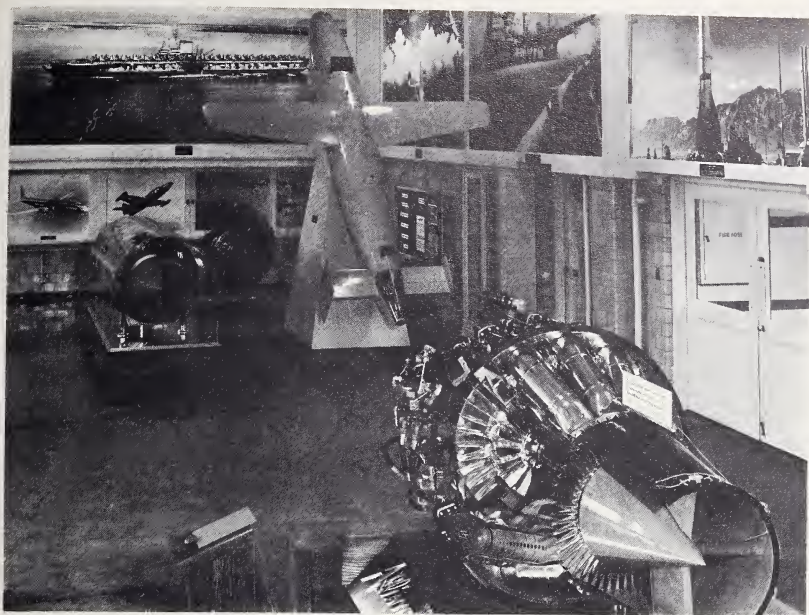
E604	Intermediate Strength of Materials
E608	Engineering Graphics II
E701	Physical Metallurgy
E707	Machine Design
E813	Continuum Mechanics
E902	Research Project



Jack Engeman



Nuclear Reactor



Model Room

Course Descriptions

E206 ENGINEERING MATERIALS. *Four Sem Hrs (3-2).* An introductory course in the applied science of engineering material. Application and extension of previously studied principles from the physical sciences to the mechanical, thermal, electrical, and magnetic properties of engineering materials. Work in metals, ceramics, and plastics; includes modern materials requirements, atomic structure and bonding, molecular structures, crystal structures and systems, noncrystalline solids, solid solutions, submicroscopic and microscopic crystal imperfections, solid state diffusion, electrical properties, magnetic properties, deformation and failure of materials, modification of properties through changes in microstructure, solid-state reactions, and multiphase materials. Laboratory work includes methods of testing and evaluation of engineering properties of materials, heat treating, phase transformations and changes in composition. *Prereq: E605.*

E207 SOLID MECHANICS. *Four Sem Hrs (3-2).* This course is the first half of a two-semester sequence on the mechanics and properties of engineering materials. It consists of statistics and an introduction to the mechanics of deformable bodies. Topical cover-

age includes: vectors and force systems, statistics of rigid bodies, equilibrium, distributed forces, centroids and moments of inertia; axial, torsional, and flexural stress and strain. Laboratory work includes graphical methods of solution of statics problems, and laboratory experiments on elastic strains and stresses in deformable bodies.

E208 ENGINEERING MATERIALS. *Four Sem Hrs (3-2).* The first part of this course is a continuation of the study of the mechanics of deformable bodies already introduced in E207. Topical coverage includes: beam deflections, combined stresses, Mohr's circle of stress, and long columns. The bulk of the course is a study of the mechanical, electrical, and thermal properties of materials from the atomic, microscopic and macroscopic viewpoint. Laboratory work includes: heat treatment of alloys, phase diagrams, creep, strain hardening, instrumented tensile test, and correlation of microstructures. *Prereq: E207.*

E211 ENGINEERING GRAPHICS AND STATICS. *Four Sem Hrs (3-2).* A basic course designed to provide an introduction to engineering graphical methods and disciplines, engineering terminology, and the method and system of engineering problem solving. Emphasis in the graphics portion is placed on spatial visualization providing creative thought and on the conveying of ideas and information through two-dimensional representations and three-dimensional freehand sketches. The statics portion, includes definition of vectors and force systems, the parallelogram law, force triangle and force polygon. It treats of coplanar force systems, moments, couples, equilibrium, and free-body diagrams; analysis of structures, trusses, frames and machine; and the centroids of areas. *Prereq: M111, M120.*

E300 SHIP HYDROSTATICS (Buoyancy and Stability). *One-Half Sem Hr (0-1).* A comprehensive laboratory study of the static forces acting on the ship afloat, both in the normal upright condition and in inclined situations, including the effects of weight additions and removals, weight shifts, and loose liquids. Stability of the ship is investigated through the use of laboratory models both in the initial condition and throughout the overall range of stability. Emphasis is given to the nature, importance, and limitations of the metacenter, ship's hull form, and loading. Analysis of damaged stability including free communication is made with support of large compartmented floodable models and inclining apparatus.

E305 THERMODYNAMICS I. *Four Sem Hrs (4-0).* A first course in the principles of energy conversions, emphasizing the classical approaches to and developments from the first and second laws of thermodynamics. The course includes properties of gases and vapors,

thermodynamic processes, Clausius' inequality, consequences of the second law, and analyses of heat power and refrigeration cycles.

E306 FLUID MECHANICS I. *Four Sem Hrs (4-0).* A first course in fluid mechanics which covers the following topics: fluid properties; fluid statics; basic flow concepts; basic equations including conservation of mass, momentum, and energy; dynamic similitude including Reynolds, Mach, and Froude numbers; and viscous effects including the boundary layer, fluid dynamic lift and drag, and frictionless compressible flow. Laboratory demonstrations are presented to verify theory.

E311 ELEMENTS OF THERMODYNAMICS. *Four Sem Hrs (3-2).* A classical treatment of the first and second laws of thermodynamics. Work, heat, and other forms of energy are covered, with particular emphasis on air and water as the working substances. The theoretical coverage is supported with laboratory exercises and problem drills.

E312 ELEMENTS OF FLUID MECHANICS. *Four Sem Hrs (3-2).* An introduction to fluid mechanics. A direct application of the equations of momentum, energy, and continuity to the flow of compressible and incompressible fluids, including viscous effects. Supporting laboratory exercises and problem drills are included.

E407 FLUID MECHANICS II. *Four Sem Hrs (3-2).* A further study of fluid mechanics involving mass, momentum, and energy in fluid systems. Included are open and closed fluid systems with both incompressible and compressible fluids. Laboratory exercises demonstrate the physical phenomena of the areas of study. *Prereq: E305, E306.*

E408 THERMODYNAMICS II. *Four Sem Hrs (3-2).* A further study of the thermodynamics including the laws of heat transfer and the liberation, conversion, transportation, and utilization of thermal energy in thermodynamic systems. Gases and vapors are considered in open and closed systems. Laboratory exercises demonstrate the thermodynamic phenomena of the areas under study. *Prereq: E305, E306, E406.*

E501 ENGINEERING DRAWING AND DESCRIPTIVE GEOMETRY. *Three Sem Hrs (3-0).* The introduction to engineering graphical methods and disciplines, with emphasis on spatial visualization providing experience in creative thought and in procedures to convey ideas through graphical communication. Instruction includes the study of both abstract and mechanical forms and their representation in two-dimensional mediums by means of freehand and instrument drawing. Topical coverage includes points, lines, planes, and solids

in space with representation by orthographic, axonometric, and oblique projections. Engineering applications involve practice in detail and assembly drawings of mechanical components.

E601 KINEMATICS. *Three Sem Hrs (3-0).* A study of displacements, velocities, and accelerations of machine elements. Topics include centros and Kennedy's Theorem; accelerations, Coriolis' Law, and Klein's Construction with typical applications such as steering mechanisms, Oldham's Coupling and Hooke's Joint; development of plate and cylindrical cam profiles, follower types, and displacements; rolling contact through friction gearing of ellipses and hyperboles; cycloidal and involute gear teeth and modifications; gear trains, rack and pinion, worm and wheel; and special devices such as the differential screw, the swash plate, and the Geneva wheel. *Prereq: E111 or E107.*

E604 INTERMEDIATE STRENGTH OF MATERIALS. *Three Sem Hrs. (3-0).* Limitations of elementary stress formulas; stresses at a point; two- and three-dimensional Mohr's circles of stress; Mohr's circle of strain; indeterminate structures; theories of failure; shear center and shear flow; unsymmetrical bending; curved flexural members; torsion of noncircular bars; stress concentrations; energy methods; Castigliano's theorem. *Prereq: E605, E107.*

E605 STRENGTH OF MATERIALS. *Four Sem Hrs (3-2).* An introduction to the mechanics of deformable bodies involving both elastic and inelastic behavior. Basic concepts and analytical procedures are emphasized throughout the course in developing the theories of the behavior of deformable bodies and in applying these theories to engineering problems. Basic analyses are not restricted to ideally elastic behavior and in all cases the limitations of derived expressions are clearly stated. Classroom work is concerned with axial stresses and strains, torsion, combined stresses, Mohr's circle, thermal stresses, shear and bending-moment diagrams, the flexure formula, the equation of the elastic curve, beam deflections, and column theory. Laboratory work is intended to show the validity as well as the limitations of the elastic theory presented in the classroom. Laboratory problems include: tensile, compressive, and torsional loading of common engineering materials, beam deflections, column tests, and some uses of electrical resistance strain gages in stress analysis. *Prereq: E111; Coreq: M211.*

E606 THEORY OF ENGINEERING EXPERIMENTATION. *Three Sem Hrs (2-2).* A course relating the theoretical, analytical, and statistical aspects of experimental work stressing the basic similarities between all types of experiments. Traditional instruments are used to introduce the concepts of error in measurement, the distribution of error in measurement, the distribution of error around a "true" value, the propagation of errors in multiple measurement systems. The plan-

ning of measurement to minimize uncertainty and a check for precision of accuracy error will also be introduced. Test point spacing, extraneous variables, control, apparatus malfunction, and inconsistency in developing data as well as statistical, graphical, and numerical methods of reducing, studying, and interpreting engineering test data and its logical presentation will be stressed. *Prereq: M111.*

E608 ENGINEERING GRAPHICS II. *Three Sem Hrs (3-0).* A course in engineering graphical methods and disciplines with emphasis on spatial visualization. Instruction includes the study of both abstract and mechanical forms and their representation in two-dimensional mediums as a means of providing experience in creative thought and as a method of conveying ideas through graphical communication. Both freehand and instrument drawing are emphasized. Studies include the theories of orthographic, axonometric, and perspective projection. Engineering applications involve practice in detail and assembly drawings of mechanical components and the representation of fair surfaces with special emphasis on the delineation of ship's lines. *Prereq: E111 or E107.*

E631 INTRODUCTION TO AERODYNAMICS. *Three Sem Hrs (3-0).* Introduction to fluid mechanics as applied to the flight vehicle. Specific areas of coverage are Newton's laws, the atmosphere, introductory fluid dynamics, aeronautical nomenclature, experimental procedures, planform and viscous effects, and introductory compressibility. *Prereq: M111.*

E701 PHYSICAL METALLURGY. *Three Sem Hrs (3-0).* A study of the principles of physical metallurgy including atomic structure, energy levels in free atoms, electron energies in solids, methods of studying crystal systems, imperfections in crystal structures, liquid and solid phases of metals, phase transformations, solid solution phase diagrams, nonequilibrium solidification, solid-state reactions, elasticity, mechanisms of plastic deformation, high temperature strength, diffusion in metals, age hardening, equilibrium heat treatment, and nonequilibrium decomposition. *Prereq: E206.*

E702 SYSTEMS ENGINEERING. *Three Sem Hrs (3-0).* Principal emphasis on the relationship between the physical system and the differential equation which expresses its behavior. First and second order systems, transfer functions for both open and closed loop systems, and frequency response methods. Emphasis on mechanical devices, with consideration given to hydraulic and electrical systems to illustrate the analogous nature of all dynamic systems. Demonstrations of simple physical devices. *Prereq: M704 or M751.*

E707 MACHINE DESIGN. *Three Sem Hrs (3-0).* Application of basic theories of mechanics of solids, kinematics, and dynamics, and

correct utilization of the properties of engineering materials in the actual design of the most common machine elements. Topics include variable loads and stress concentrations, dynamic loading, thermal-differential expansion, springs, gearing, bearings, thin and thick film lubrication, strength and durability of gears, shafting, flywheels, and other selected subjects. Various design and analysis projects are assigned throughout the course. *Prereq: E601, E604, M305.*

E708 HEAT TRANSFER I. *Three Sem Hrs (3-0).* Introductory study of engineering heat transfer. Topics include the theory of steady-state conduction in one, two and three dimensions, transient conduction; heat conduction with heat source, finned surfaces; radiation between black surfaces, radiation between gray surfaces; analytical methods, numerical methods, and electrical analogies. The application of fluid dynamic principles to the study of free and forced convection; flow characteristics in ducts, over flat plates and through tube bundles; heat exchanger design; aerodynamic heating. Applications to design incorporating conduction, radiation and convection heat transfer. *Coreq: E306 or E312.*

E709 REACTOR PHYSICS I. *Three Sem Hrs (3-0).* Fundamental aspects of atomic and nuclear structures are given emphasis. Natural and induced radioactivity, laws of radioactive decay, including a demonstration of half life, binding energy and nuclear stability, compound nucleus, liquid drop model and theory of fission, cross sections including a demonstration of total cross section, Maxwell-Boltzmann distribution of thermal neutrons, center of mass system and laboratory system mechanics, slowing down density, resonance escape probability, thermal utilization factor, and the four-factor formula for k (infinite). Brief introduction to the meaning of Fermi age and diffusion length, both the physical meaning and the mathematical derivation of these probabilities on nonfast and nonslow leakage of neutrons. Material and geometric buckling. Finally, the diffusion equation and the critical equation applied to a thermal reactor. *Prereq: M220.*

E710 REACTOR PHYSICS II. *Four Sem Hrs (3-2).* The interaction of nuclear radiations with matter involving alphas, betas, and a basic mathematical approach to the photoelectric effect, Compton scattering, and pair production of gamma radiation. Health physics and the biological effects of radiation. Radiation detection and measurement. Basic attenuation of radiations exponentially and by the inverse square laws. Laboratory work in the nucleonics laboratory involving basic training with scalers, flux mapping of the subcritical assembly both with foils and the BF_3 probe. *Prereq: E709.*

E731 AERO STRUCTURES I. *Three Sem Hrs (3-0).* An application of the principles of solid mechanics to the lightweight structures of flight vehicles. Specific topics include analyses of beams,

frames, rings, closed sections, and thin plates. Methods employed include slope-deflection, moment distribution, virtual work, least work, strain energy elastic center and La Grange's equation. Applications of these principles to practical problems in aerospace vehicles are stressed. *Prereq: E605.*

E732 AERODYNAMICS I (Alternate for E312). *Four Sem Hrs (3-2).* A study in perfect fluid theory. The basic principles of aerodynamics are introduced and applied to specific problems. Topics covered include the fluid medium, kinematics of a fluid field, dynamics of a fluid field, the flow about a body, thin airfoil theory, finite wing theory, and an introduction to the dynamics of a viscous fluid. Laboratory work is included. *Prereq: E631; Coreq: M704 or M751 and M752.*

E734 AERO PERFORMANCE. *Three Sem Hrs (3-0).* The basic principles of aerodynamics are extended to include a detailed analysis of aircraft drag. The several types of flight vehicle powerplants are described and their performance characteristics are introduced. The criteria for powerplant selection based on mission analysis are discussed. Drag analysis and powerplant characteristics are combined to determine vehicle performance, including the performance envelope, generalized performance methods, range and endurance, takeoff and landing, and maneuvering flight. Finally, design considerations are discussed. *Prereq: E631.*

E744 MECHANICAL BEHAVIOR OF MATERIALS. *Three Sem Hrs (3-0).* A treatment of the mechanical properties and behavior of materials. Elastic, plastic, viscous, and viscoelastic behavior will be treated with the emphasis placed on gaining an insight into the reasons for the different types of behavior rather than mathematical rigor. Modes of failure including brittle fracture, ductile fracture, rupture, stress corrosion cracking, creep, and fatigue will also be considered in the laboratory. *Prereq: E605, E701.*

E801 NAVAL ARCHITECTURE I—HYDROSTATICS. *Four Sem Hrs (3-2).* Hull form types; ship geometry, nomenclature and hydromechanic parameters; form coefficients; hull form delineation; fairing and lofting practices. Form calculations; methods of determining areas, volumes, moments. Computations for displacement, center of buoyancy, center of gravity and wetted surface. Transverse and longitudinal stability. Stability curves and corrective factors. Free surface and free communication effects. Preparation of hydrostatic curves floodable length curves; watertight subdivision. *Prereq: E306.*

E802 NAVAL ARCHITECTURE II—HYDRODYNAMICS. *Four Sem Hrs (3-2).* A basic study of ship's hydrodynamics with particular emphasis on the study of various resistance components and flow phenomena, both in still water and in regular waves. The study further

includes ship motions among waves, submerged control surfaces, propulsive theory, dynamically supported craft and hydrofoils. Laboratory work includes exercises in basic towing tank techniques, with tests relating model resistance to full-scale prototype's effective horsepower, horsepower augmentation in a head sea, normal rudder forces, synchronous rolling, and hydrofoil phenomena. The study further demonstrates the uses of Taylor's Standard Series, Schoenheer's Line, and other friction formulations. *Prereq: E801.*

E807 GAS POWER PROPULSION I. *Three Sem Hrs (3-0).*

This course is intended to give an over-all view of the methods of modern gas dynamics and their relation to propulsion systems. Topics covered include: Thermodynamics of perfect and real gases; fundamental theorems of one dimensional compressible subsonic and supersonic flows; flow in ducts with viscous and thermal effects; nozzle and diffuser theory; shock wave; Prandtl-Meyer flow and characteristics theory in nozzle design. *Prereq: E306, or E732, and M704 or M751.*

E808 GAS POWER PROPULSION II. *Three Sem Hrs (3-0).*

Generalized methods in gas dynamics, detonation and deflagration theory; one dimensional nonsteady flows; characteristics and waves in non-steady flows; shock tube theory; pressure exchange and combustion in nonsteady flows; dynamic flow machines, steady and nonsteady thrust generators. *Prereq: E807.*

E809 MECHANICAL VIBRATIONS. *Three Sem Hrs (3-0).*

A study of vibrations including two or more degrees of freedom in conservative and nonconservative systems. Classical and operational (Laplace) mathematical techniques will be used. The analog approach will be given. Although primary emphasis will be upon mechanical vibrations, solution of similar fluid, heat transfer and electrical problems will also be stressed. *Coreq: M751 or M704.*

E811 SHIP'S STRUCTURES. *Three Sem Hrs (3-0).*

The theory of the strength of ships including: Longitudinal bending moments in still water and among waves and analysis by ships strength curves, the Beam Theory as applied to ships and the longitudinal strength numbers. Section modulus calculations. Deflection of ships, transverse strength, and strength of plating. The general and local structural reactions with considerations to materials, hull configurations, modes of failure, plate theory, framing systems, etc. Development and optimization of the primary longitudinal structure. The transverse structure with structural analysis of the continuous frame, web frames and transverse bulkheads. Structures under dynamic loadings with emphasis on the primary longitudinal hull structure. *Prereq: E605, E801, E802.*

E813 CONTINUUM MECHANICS. *Three Sem Hrs (3-0).* An introduction to mechanics of linear and nonlinear continuous media.

Emphasis on constructing mathematical models of real materials. Topics include vectors, matrices, Cartesian tensors, index and dyadic notation, stress, conservation of mass, linear momentum and energy, invariance requirements, constitutive equation, non-Newtonian fluids and non-Hookian solids, normal stress effects, and rheological behavior. *Prereq: E306, and M704 or M601 and M751.*

E831 AERODYNAMICS II. *Three Sem Hrs (3-0).* An advanced course in aerodynamics covering the Navier-Stokes equations and the boundary layer approximation. Incompressible and compressible laminar boundary layers. Transition; turbulent boundary layers. Convective heat transfer in laminar and turbulent flow. An introduction to supersonic wing theory and hypersonic and high temperature flows. *Prereq: E732, E807.*

E832 AERO STRUCTURES II. *Three Sem Hrs (3-0).* Thin-walled elements with emphasis on shearing stresses. Torsional analysis of wings and fuselages. Elastic stability, including beam-columns. Introduction to the bending of thin, flat plates. Membrane stresses in pressure vessels. Analysis of skin-stringer structural systems. Basic elements of design of flight vehicles, including the concept of weight/strength. *Prereq: E731; Coreq: M704 or M751.*

E834 ORBITAL MECHANICS. *Three Sem Hrs (3-0).* An introductory treatment of the elements of space flight. The orbits of planets and satellites, including the suborbital and escape cases, are approached from consideration of classical mechanics. Orbit control, effects of earth oblateness and the optimization of rocket-propelled vehicle trajectories are considered. *Prereq: M704, or M751 and M752.*

E835 STABILITY AND CONTROL. *Three Sem Hrs (3-0).* The aerodynamic and inertial forces and moments acting on the flight-vehicle and its parts are analyzed to determine their effect on static and dynamic stability. Control power required and control forces necessary for maneuvering flight and to overcome instability are considered. The resulting flying qualities of the aircraft are then examined. Finally, the concepts developed are briefly specialized to aerospace vehicles. *Prereq: E734.*

E836 AERO DESIGN. *Three Sem Hrs (3-0).* Preliminary design of a flight vehicle. Includes preliminary layout, weight and balance estimates, performance analysis, stability analysis, and structural analysis. Detail consideration will be given to one aspect of the design, e.g., performance, stability, or structure. *Prereq: E731, E734.*

E902 ENGINEERING RESEARCH PROJECT. *Three Sem Hrs (3-0).* A creative, scientific research project in the field of the student's interest, approved by the engineering research adviser in the Department.

English, History, and Government Department

Head of Department: Captain C. J. Merdinger; **Executive Officer:** Commander F. E. Day, Jr.; **Senior Professor:** W. W. Jeffries; **Professors:** E. B. Potter, E. M. Hall, E. J. Mahoney, J. R. Fredland, D. R. Lacey, N. T. Kirk, A. S. Pitt, R. S. West, Jr., P. E. Coletta, A. B. Cook, J. R. Cutting, R. W. Daly, W. L. Heflin, W. B. Lewis, R. L. Mason, J. R. Probert, J. C. Reed, H. O. Werner; **Foreign Service Officer:** R. T. Hennemeyer; **Associate Professors:** H. H. Adams, N. A. Anderson, J. A. Arnold, H. H. Bell, Jr., W. M. Belote, R. A. Bender, J. P. Boatman, T. Boyajy, W. L. Calderhead, T. P. Carpenter, E. H. Clark, Jr., C. L. Crane, Jr., W. M. Darden, P. C. Dunleavy, J. W. Huston, R. M. Langdon, R. Megargee, R. M. Paone, J. T. Pole, A. A. Richmond III, W. H. Russell, R. Seager II, R. A. Williams, H. A. Wycherly, J. N. Wysong; **Lieutenant Commanders/Majors, USMC:** R. H. Jermstad, H. O. Mains, Jr., F. B. Shemanski, W. R. Corson, R. R. Mecker, Jr.; **Assistant Professors:** A. C. Ballas, B. K. Dehmelt, H. C. Durham, Jr., P. J. Hurley, A. M. Rose, J. T. Skehan, J. P. Thomas, Jr.; R. C. Vitzthum, L. C. Wilson; **Lieutenants/Captains, USMC:** C. G. Andres, M. T. Doss, Jr., M. M. Eisman, L. J. Flink, W. F. Kimball, R. F. Marryott, D. L. McCarthy, H. F. Philson, G. E. Skaggs, S. B. Sloane; **Lieutenants (jg)/1st Lieutenants, USMC:** L. E. Chappuie, P. D. Flynn, W. H. Hardesty III, M. J. McAuley, D. D. Mordecai, F. H. Mullen, G. H. Wheelock, B. L. Whitaker; **Ensigns:** G. W. Sutton.

Mission

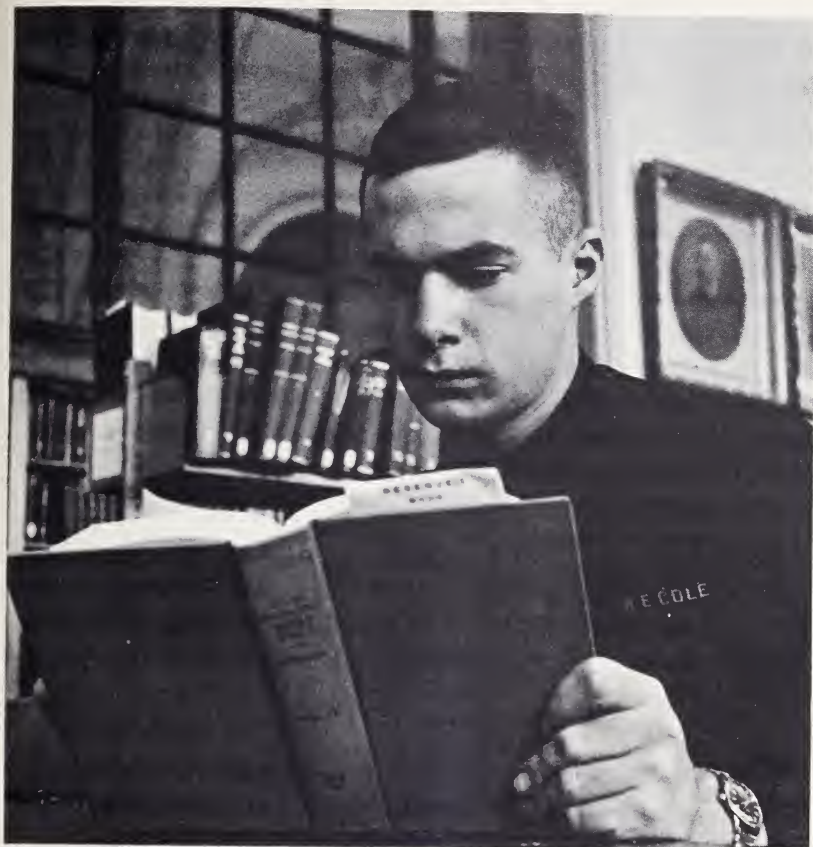
The mission of the English, History, and Government Department is to educate the midshipman as a discriminating individual with an understanding of history, government, economics, and literature, and to develop in him a mature ability to read with comprehension and appreciation, to write with clarity and style, and to speak with conviction and poise. In support of this mission, the department offers some 57 electives in addition to the standard course of 24 semester hours required of every midshipman.

Facilities

The English, History, and Government Department occupies Maury Hall adjacent to the Naval Academy Library. In addition to the usual recitation rooms, there are rooms with motion picture, slide, microfilm, and tape-recording equipment to give midshipmen an opportunity to view events of historical and educational note and hear readings of great literature. There are also auditoriums in the immediate vicinity of the Department available for large group presentations.

Core Courses

- H101 Composition and Literature or H103, Advanced Course
- H102 Composition and Literature or H104, Advanced Course
- H201 Modern European History Since 1789
- H300 Speech
- H303 United States Government and Constitutional Development
- H304 Economic Analysis
- H403 History of Seapower
- H404 Readings in Western Ideas
After-Dinner Speaking
- H406 Foreign Policy



Minors Program

Foreign Affairs

- H639 International Relations and Organization
- H732 Soviet History and Contemporary Problems
- H737 Modern Middle Eastern Problems, or
- H739 Far Eastern Relations of the United States
- H746 Comparative Government
- H938 Research Seminar in Area Studies
- Any Foreign Affairs elective, series 700 or above

Literature

- H721 The Western Literary Heritage I
- H722 The Western Literary Heritage II
- H821 The Western Literary Heritage III
- H822 The Western Literary Heritage IV
- H921 Seminar in Representative Contemporary Novelists or any Foreign Language Literature course, series 800
- H922 Seminar in Representative Playwrights or any Foreign Language Literature course, series 800
- H924 Seminar in Critical Evaluation of Literature

History

- H611 Western Civilization to 1500
H612 History of Europe, 1500-1815
H735 Modern Far Eastern Problems,
or
H737 Modern Middle Eastern
Problems
H732 Soviet History and Contem-
porary Problems, or
H738 Latin American History and
Contemporary Problems
Any History elective, 700 series
or above
Any History seminar except
H940

Politics and Economics

- H635 U.S. Economic History, or
H745 Comparative Economic
Systems
H743 Political Theory, or
H843 Constitutional Law
H848 Money and Banking, or
H846 Economics of Labor Relations
H746 Comparative Government, or
H744 Communism: Theory and
Practice
Any Politics and Economics
elective, 600 series or above
H942 Research Seminar in Politics
and Economics

Majors Program*

Foreign Affairs

- H743 Political Theory, or
H735 Modern Far Eastern Problems
H638 Economic Geography
H831 Europe in the Twentieth
Century, or
H745 Comparative Economic
Systems
H738 Latin American History and
Contemporary Problems, or
H748 International Law
H837 International Trade and
Finance
Any Foreign Affairs elective
offered by this or Foreign
Languages Department, 700
series or above

Literature

- H621 Twentieth Century
American Literature, or
H625 Introduction to Philosophy
and Logic
H622 Twentieth Century British
Literature
H623 Major British Writers, 14th-
18th Centuries
H624 Major British Writers, 19th
Century
H723 Shakespeare and His
Contemporaries
H724 Classic American Writers

History

- H631 U.S. History to 1865
H632 U.S. History Since 1865
H731 History of Russia to 1917, or
H835 American Colonial History
H834 Modern European Revolutions
or
H746 Comparative Government
Any History elective, 700
series or above
H940 Research Seminar in History

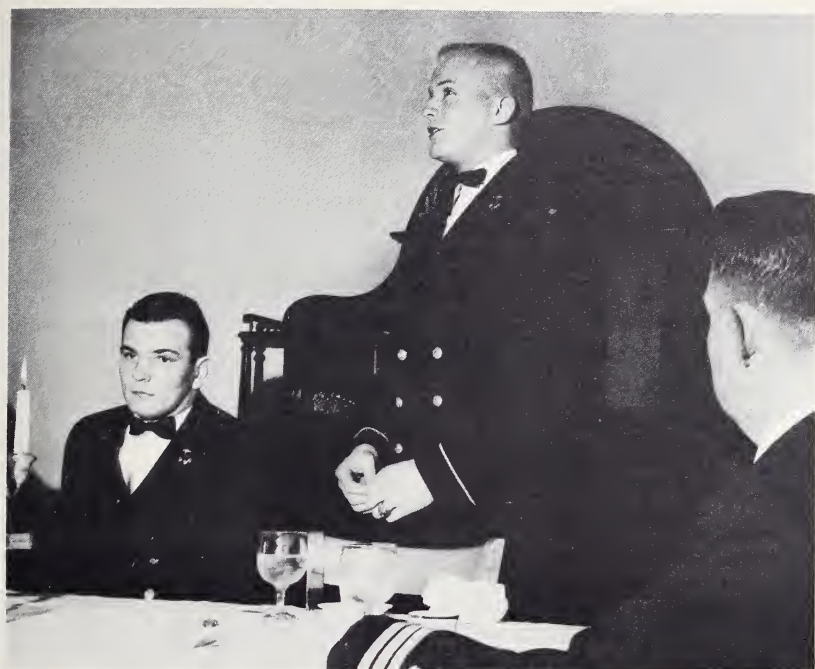
Politics and Economics

- H635 U.S. Economic History, or
H745 Comparative Economic

Systems

- H638 Economic Geography
H841 Advanced Economics and
Problems of Defense Plan-
ning, or
H473 Political Theory
M770 Introduction to Mathematical
Economics, or
H748 International Law
H837 International Trade and
Finance, or
H849 National Security Policy
Any Politics and Economics
elective, 700 series or above

* Note: Courses listed under major are *additional* to those required under the corresponding minor.



After Dinner Speaking

Course Descriptions

H101 COMPOSITION AND LITERATURE. *Three Sem Hrs (3-0).* Primary emphasis is on developing efficiency in reading and in oral and written communication. Reading and discussion of selections from major American writers, with frequent quizzes. Weekly themes based on the readings and exemplifying basic forms of exposition: definition, classification, analysis, argument, criticism, comparison and contrast, etc. Individual conferences on composition in class. Practice in the use of the dictionary, social and naval correspondence, and public speaking. Library visits, with drill in research techniques.

H102 COMPOSITION AND LITERATURE. *Three Sem Hrs (3-0).* A continuation and development of H101. Primary emphasis is on developing efficiency in reading and in oral and written communication. Reading and discussion of selections from British writers, with frequent quizzes. Extensive practice in writing themes based on the readings and exemplifying basic forms of exposition. Individual conferences on composition in class. Library visits, with drill in research techniques.

H103 COMPOSITION AND LITERATURE, ADVANCED COURSE. *Three Sem Hrs (3-0).* This course is designed for mid-

shipmen with exceptional aptitude for composition and literature (approximately 10 percent). The general objectives are the same as those of H101, except that there is more emphasis on critical writing, and selected American authors are studied more intensively.

H104 COMPOSITION AND LITERATURE, ADVANCED COURSE. *Three Sem Hrs (3-0).* This course is designed for midshipmen with exceptional aptitude for composition and literature (approximately 10 percent). The major types of English literature are studied in complete works by outstanding men of letters. The general objectives are the same as those for H102, except that there is more emphasis on critical writing.

H201 MODERN EUROPEAN HISTORY SINCE 1789. *Three Sem Hrs (3-0).* The objective of this course is to give midshipmen a knowledge of the historical development of Europe since 1789. Attention will be given to the impact of events in Europe upon the rest of the world and also to the effect 20th-century developments have had upon European nations and their roles in world affairs. Lectures, collateral readings, and a course paper broaden the scope of the textbook.

H204 UNITED STATES DIPLOMATIC HISTORY AND GEOGRAPHY. *Three Sem Hrs (3-0).* This course is designed to acquaint the midshipmen with the historical development of the foreign policy of the United States from the time of the American Revolution to the present. It stresses the basic principles and forces which have shaped the foreign policy of the United States and its conduct among the nations of the world.

The lessons in geography are designed to acquaint the midshipmen with the major geographic facts and principles which contribute to a nation's development, power, and policies, and to develop an appreciation of geographic forces in world affairs.

H300 SPEECH. *Three-Quarters Sem Hrs (¾-0).* This course emphasizes speech composition and platform performance with the general objective of improving the midshipmen's general proficiency in oral expression. Attention is paid to *ex tempore* speaking, conference procedures, and presentations and briefings.

H303 UNITED STATES GOVERNMENT AND CONSTITUTIONAL DEVELOPMENT. *Three Sem Hrs (3-0).* The objectives of this course are: (1) to implant in the midshipmen an understanding of the basic concepts of American democracy; (2) to establish an understanding of the Constitution and a knowledge of constitutional development; (3) to familiarize the student with the structure and functions of his government and the forces and factors which influence its operation; (4) to acquaint him with the nature and effects of administrative law; and (5) to compare his government with other types of government.

H304 ECONOMIC ANALYSIS. *Three Sem Hrs (3-0).* The objectives of this course are to teach the midshipmen the laws of economic behavior, to give them a comprehension of American economic institutions, to familiarize them with the role of government in the economy in peace and war, and to develop their understanding of the elements of personal finance.

H403 HISTORY OF SEAPOWER. *Three Sem Hrs (3-0).* The objective of this course is to provide the midshipmen with information basic to their profession, such as: (1) the development of naval ships and weapons; (2) the evolution of naval tactics and amphibious doctrine; (3) the reasoning behind historic strategic decisions; (4) the influence of seapower upon history; and (5) the qualities of character and professional competence which have made great naval leaders. The nature and significance of seapower are studied in terms of their historical development successively in the Mediterranean, Atlantic, and Pacific regions. The major portion of the course is devoted to the evolution after 1900 of the surface, air, and undersea components, but the influence of changing technology on tactics and the relation of both to naval strategy provide the basic frame of analysis throughout the course. U.S. naval leadership and operations are emphasized, and the course is concluded with a consideration of the problems of integrated American defense.

H404 READINGS IN WESTERN IDEAS. *Three Sem Hrs (3-0).* The objective of this course is to develop the midshipmen's intellectual maturity (1) by exploring some of the problems of human existence; (2) by deepening their understanding of human personality; (3) by sharpening their perceptions of literary values through writings and discussion; and (4) by improving their powers of oral and written expression. There is no single standard textbook. Course work involves the reading and the discussing of at least five masterpieces selected from world literature, past and present. The readings and the discussions in any one class section are related to a single thematic objective. The instructor makes his own title selections for the class section; he then directs the classroom discussion toward the objective adopted. Examinations and formal essays emphasize advanced composition.

After-Dinner Speaking. Throughout first class year, small dinners are given under the auspices of the English, History, and Government Department, with the primary objective of providing a setting for midshipman after-dinner speaking under realistic circumstances. Outside guests of honor and faculty members are present. Each member of the First Class participates in at least two of these dinners. No academic credit is granted.

H502 READINGS IN THE LITERATURE OF DEMOCRACY. *Three Sem Hrs (3-0).* A study of selections of literary merit dealing

with ideas basic to democratic government: books, tracts, essays, letters, documents, speeches, and public pronouncements. Literary qualities of the selections are emphasized. This course carries credit in all fields of concentration in this Department.

H611 WESTERN CIVILIZATION 1 TO 1500. *Three Sem Hrs (3-0).* A survey of the history of Western civilization during the ancient and medieval periods. Attention is given to political economic, and social developments and to the cultural contributions of each people and period.

H612 HISTORY OF EUROPE, 1500-1815. *Three Sem Hrs (3-0).* A survey course in which the following major developments will be studied: the rise of Spain, England, and France as national states, the development of absolute monarchy, the era of oceanic exploration and of overseas colonization, the rise of capitalism, the Protestant Revolt or Reformation, the Scientific Revolution, the development of constitutional government, the rise of Russia and Prussia, and the French Revolution and Napoleon. Readings presenting differing points of view will be used as a basis of discussion.

H621 TWENTIETH CENTURY AMERICAN LITERATURE. *Three Sem Hrs (3-0).* Readings from the major writers of American fiction, poetry, and the drama since 1920. Especial attention to representative works of such authors as Lewis, Fitzgerald, Hemingway, Faulkner, Steinbeck, O'Neill, Williams, and Miller. *Prereq: H101, 102.*

H622 TWENTIETH CENTURY BRITISH LITERATURE. *Three Sem Hrs (3-0).* Readings from the major British writers of fiction and poetry since 1900. Especial attention to representative novels of Conrad, Lawrence, Joyce, Huxley; Waugh, Greene, and Caryl. *Prereq: H101, 102.*

H623 MAJOR BRITISH WRITERS, 14th-18th CENTURIES. *Three Sem Hrs (3-0).* Intensive study of selected works of principal figures in the literature of England such as Chaucer, Malory, Spenser, Doone, Milton, Pope, and Fielding their thought and art, their historical background, their significance as representatives of their times, and their contributions to the culture of the English-speaking nations. *Prereq: H101, 102.*

H624 MAJOR BRITISH WRITERS, 19th CENTURY. *Three Sem Hrs (3-0).* Intensive study of selected works of principal figures in the literature of England in the nineteenth century such as Wordsworth, Keats, Scott, Dickens, Tennyson, Browning, Arnold and Hardy; their thought and art, their historical background, their significance as representatives of their times, and their contributions to the culture of the English-speaking nations. *Prereq: H101, 102.*

H625 INTRODUCTION TO PHILOSOPHY AND LOGIC.

Three Sem Hrs (3-0). A study of the problems and methods of philosophy and the solutions suggested by various philosophers. Included is a brief nontechnical introduction to the analysis of deductive and inductive reasoning, sound definition, and logical fallacies.

H631 UNITED STATES HISTORY TO 1865.

Three Sem Hrs (3-0). An historical study of development of American civilization from 1763 through the Civil War. Attention is paid to the historical foundations of the nation and culture including the American Revolution, the growth of nationalism, the westward movement and the sectional crisis. Emphasis is placed upon the development of the major institutions of the United States which had their origins within this period.

H632 UNITED STATES HISTORY SINCE 1865.

Three Sem Hrs (3-0). A continuation of the study of American civilization from the Reconstruction Period to the present, emphasizing the course of industrialization, the settlement of the West, and the emergence of the United States as a world power. In the 20th century attention is paid to the development of our present society through the impact of the two World wars and the depression.

H635. UNITED STATES ECONOMIC HISTORY.

Three Sem Hrs (3-0). A study of the American economy from colonial times to the present, with special emphasis on the interrelations between the ways Americans have made a living and their social and political attitudes, on America's role in the world economy, and on the rise of the large corporation.

H638 ECONOMIC GEOGRAPHY.

Three Sem Hrs (3-0). The study of earth science insofar as it affects man's patterns of production, distribution, and consumption: population, climatology, soil characteristics, distribution of mineral resources, etc.

H639 INTERNATIONAL RELATIONS AND ORGANIZATION.

Three Sem Hrs (3-0). This course deals with contemporary problems of U.S. diplomacy as well as the basic theories and principles of international relations. It also stresses the United Nations and regional organizations and their roles in international relations. Extensive opportunity is provided for the study of policy as well as the appropriate diplomatic strategy to be applied as possible solutions to major international problems.

H721, H722, H821, H822 THE WESTERN LITERARY HERITAGE.

The basis of the Literature Minor is a four-semester sequence called The Western Literary Heritage, which comprises a study of the most significant and characteristic literary productions of Western civilization from ancient times to the present. There are four divisions of the course (corresponding to the four semesters of Second and First

Class years) with the subtitles:

H721. I Classical Literature

H722. II Medieval and Renaissance Literature

H821. III Continental Literature, 17th–19th Centuries

H822. IV Continental Novels, 19th–20th Centuries

H721 THE WESTERN LITERARY HERITAGE I: Classical Literature. *Three Sem Hrs (3–0).*

Greece

Greek mythology. Homeric Epic: *Iliad*. Hellenic humanism: the tragedies of Aeschylus, Sophocles, Euripides. Satiric comedy: Aristophanes. The historians: Herodotus, Thucydides, Xenophon.

Rome

Roman Epic: Virgil, *Aeneid*. Roman comedy: Plautus and Terence. Caesar, *Commentaries*. Roman poetry: Catullus, Martial, Horace, Ovid.

Hebrew and Christian Scriptures.

Prereq: H101, 102.

H722 THE WESTERN LITERARY HERITAGE II: Medieval and Renaissance Literature. *Three Sem Hrs (3–0).*

Medieval Europe

Medieval Epic: *Beowulf*; *The Nibelungenlied*. Romance Literature: *The Song of Roland*; *The Cid*; *Aucassin and Nicolette*; *The Romance of the Rose*; Francois Villon. Marco Polo, *Travels*. Dante, *The Divine Comedy*. Medieval drama. Goliardic verse.

The Renaissance

Petrarch, *Sonnets*. Boccaccio, *Decameron*. Castiglione, *The Courtier*. Machiavelli, *The Prince*. Erasmus, *The Praise of Folly*. Rabelais, *Gargantua and Pantagruel*. Montaigne, *Essays*. Cellini, *Autobiography*.

Prereq: H101, 102.

H723 SHAKESPEARE AND HIS CONTEMPORARIES. *Three Sem Hrs (3–0).* Intensive study of the major dramatic works of Shakespeare against the background of Tudor and Stuart life and literature, especially the plays of Shakespeare's fellow dramatists of the English Renaissance. Special consideration of Shakespeare's thought, dramatic development, and literary stature, particularly as revealed by comparison of his plays with the dramatic works of his contemporaries. *Prereq: H101, 102.*

H724 CLASSIC AMERICAN WRITERS. *Three Sem Hrs (3–0).* Readings in the works of the major American literary figures of the 19th century: Poe, Emerson, Thoreau, Hawthorne, Whitman, Melville, Clemens, and Henry James; their literary careers, the sources (particularly the native sources) of their ideas and art, their significance as representatives of their times, and their contributions to American civilization. *Prereq: For 1/C and 2/C only.*

H731 HISTORY OF RUSSIA TO 1917. *Three Sem Hrs (3-0).* An introduction to the political, cultural, and social history of Russia from the founding of the Moscow Principality through its expansion down to 1914. The growth of national consciousness, drive, and objectives will be emphasized, together with the factors fostering the anomalous survival of the principle of autocracy from the 13th-century Mongol invasion.

H732 SOVIET HISTORY AND CONTEMPORARY PROBLEMS. *Three Sem Hrs (3-0).* An examination into the development of the Soviet Union, detailing the overthrow of the Provisional Government, the Civil War, and the consolidation of power under Lenin, Stalin, and Khrushchev. Particular emphasis will be placed on the various policies adopted by the Soviet regime in meeting its foreign and domestic problems, to include economic, political, and social developments within the Union, in the Orient, and in Europe.

H735 MODERN FAR EASTERN PROBLEMS. *Three Sem Hrs (3-0).* This course is designed to provide an understanding of the recent history and contemporary problems of the Far East. It will present a brief introduction to traditional Oriental culture and institutions, then proceed to discuss the impact of Western culture, technology, and political systems in the 19th century, and conclude with an examination of the problems accompanying the emergence of Asian nationalism in the 20th century. *Prereq: H201, 204.*

H737 MODERN MIDDLE EASTERN PROBLEMS. *Three Sem Hrs (3-0).* This course is designed to provide an understanding of the current international tensions and problems centered in the Middle Eastern area. A thorough grounding will be given in the essential elements of Middle Eastern history, culture, and sociology, and then the problems of internal and international political tensions in the area will be studied in detail. Special emphasis will be placed upon problems of naval and diplomatic importance including Middle East oil and the penetration of Soviet influence into the area. *Prereq: H201, 204.*

H738 LATIN AMERICAN HISTORY AND CONTEMPORARY PROBLEMS. *Three Sem Hrs (3-0).* A survey designed to provide reasonable familiarity with the origins and growth of our southern neighbors. The complex threads of independence won by vice royalities, fragmentation by nationalism, and the rise of national leaders will be subordinated in emphasis to the development of the forces shaping Pan-Americanism. The significance for Latin America, the United States, and the world of the ideal of "La Patria Grande" will be explored. A reading knowledge of Spanish or Portuguese will be desired though not required. *Prereq: H201, 204.*

H739 THE FAR EASTERN RELATIONS OF THE UNITED STATES. *Three Sem Hrs (3-0).* A consideration of development

of the diplomatic, cultural, and economic relations of the United States and the Far East. Special emphasis is placed on developments since 1850, particularly upon the interaction of the foreign policies of the United States with those of the major Far Eastern Powers as the latter were stimulated by imperialism, nationalism, industrialism, democracy, and communism. *Prereq: H201*

H743 POLITICAL THEORY. *Three Sem Hrs (3-0).* The philosophic bases of the various forms of government, with emphasis on the roots of democracy; the political writings of Plato, Aristotle, St. Thomas Aquinas, Hobbes, Locke, Montesquieu, Hamilton, Jefferson, Madison, Hegel, Nietzsche, Pareto, Wilson; the great documents: *Magna Carta*, the *Declaration of Independence*, the *U.S. Constitution*, the *Atlantic Charter*, etc.; legal codes; the *Common Law*. *Prereq: H201, 204.*

H744 COMMUNISM: THEORY AND PRACTICE. *Three Sem Hrs (3-0).* A study of the philosophy of communism from the writings of Engels, Marx, Lenin, and Stalin; history of the Internationals; the role of Comintern and the "international party", relations of the Soviet Union with radical parties outside Russia, and with European Social Democratic parties; policies in the satellite nations; the security problems in the Western democracies. *Prereq: H303.*

H745 COMPARATIVE ECONOMIC SYSTEMS. *Three Sem Hrs (3-0).* A study of the various possible methods of economic organization—in theory and in practice. An assessment in detail of the different solutions to the problems of production, distribution and growth under free enterprise, mixed capitalism, and detailed economic planning. *Prereq: H201, 204.*

H746 COMPARATIVE GOVERNMENT. *Three Sem Hrs (3-0).* A comparative study of the governments of the United Kingdom, France, the German Federal Republic, the Soviet Union, Communist China, Japan, and India. The political institutions of each of these countries are studied in terms of (a) constitutional development, (b) policymaking machinery, (c) political parties and the formation of public opinion, (d) economic controls and social programs, (e) foreign policy, (f) military policy and administration, (g) the legal system, and (h) relations with the international community. *Prereq: H303.*

H748 INTERNATIONAL LAW. *Three Sem Hrs (3-0).* A survey of the public law of nations including the law of peace and the law of war. The history and theory of international law are studied; problems and cases are used to make the subject live and current. Attention is also given to the role of international law in international relations. *Prereq: 303.*

H749 COMMUNIST CHINA. *Three Sem Hrs (3-0).* An examination of the background and development of the Communist People's

Republic of China to include the Chinese Communist Revolution and Civil War (1927–49). Further analysis will deal with the economic, political, and foreign policies used by the Chinese Communists since 1949 up to the present. This analysis will be integrated and evaluated with the original contributions of Mao Tse-tung to Communist theory to indicate the ideological content of Chinese Communist actions. Particular emphasis in this latter phase will be directed to an analysis of Mao's strategic concept of revolutionary wars of national liberation and the utilization of guerrilla warfare by the emerging nations of Asia and Africa.

H821 THE WESTERN LITERARY HERITAGE III: Continental Literature, 17th–19th Centuries. *Three Sem Hrs (3–0).* Cervantes, *Don Quixote*. Moliere, *Comedies*. Rousseau, *The Social Contract*. Voltaire, *Candide*. Goethe, *Faust*. *Prereq: H101, 102.*

H822 THE WESTERN LITERARY HERITAGE IV: Continental Novels, 19th–20th Centuries. *Three Sem Hrs (3–0).*

The French Novel

Balzac, *Old Goriot*; Zola, *Germinal*; Proust, *Remembrance of Things Past*.

The Russian Novel

Dostoevski, *Crime and Punishment*; Tolstoi, *War and Peace*; Turgenyev, *Fathers and Sons*.

The German Novel

Mann, *The Magic Mountain*.

Prereq: H101, 102.

H831 EUROPE IN THE TWENTIETH CENTURY. *Three Sem Hrs (3–0).* An examination of the developments which gave European nations their predominant importance in the first part of the 20th century and of the impact of two world wars, the great depression and the cold war upon the status of these nations and their positions in contemporary affairs. *Prereq: H201.*

H834 MODERN EUROPEAN REVOLUTIONS. *Three Sem Hrs (3–0).* A comparative study of the origins, nature, and historical significance of the three great European revolutions of modern times which occurred in 17th-century England, 18th-century France, and 20th-century Russia. *Prereq: 1/C only or permission of instructor.*

H835 AMERICAN COLONIAL HISTORY. *Three Sem Hrs (3–0).* This course deals with the origins of American civilization from the age of discovery to 1763. Emphasis is placed upon the founding of the colonies and their development in the 17th and 18th centuries. Study is made of the American origins of such institutions as slavery, representative government, religion, law, and the military. *Prereq: H631.*



The Turkish Ambassador Discusses Cyprus Problems
at 1965 Naval Academy Foreign Affairs Conference

H837 INTERNATIONAL TRADE AND FINANCE. *Three Sem Hrs (3-0).* An introduction to the principles, practices, and institutions of international finance and trade. Included in the scope of the course are: balance of payments, trade policies and agreements, financial and trade practices, and international agencies in the area of finance and trade and their functioning. *Prereq: H304.*

H838 ECONOMIC DEVELOPMENT. *Three Sem Hrs (3-0).* The study of theories of economic development as applied to contemporary problems in the field, with emphasis on population factors, geographic environment, and institutions as determinants of the rate of growth. The course includes consideration of foreign trade relationships, banking arrangements, supply of domestic and foreign capital. Some attention is given to problems of administering an AID program. *Prereq: H304.*

H839 UNITED STATES MILITARY HISTORY AND POLICY. *Three Sem Hrs (3-0).* A survey of U.S. military history and policy from colonial times to the present. It provides extensive opportunity to analyze major land and pertinent sea campaigns, problems of logistics, the implementation of national policy by the military forces and the relationship between the U.S. military staffs and the civil government, the effect of airpower on strategy, and concepts of nuclear warfare. *Prereq: 1/C only or permission of instructor.*

H840 ELEMENTS OF LAW. *Three Sem Hrs (3-0).* Introduction to jurisprudence. The essentials of the law of crimes, contracts, torts, agency, real and personal property, domestic relations, testaments, negotiable instruments, and taxation, with a view of familiarizing the student with those branches of the law he is most likely to encounter in his role as citizen and officer of the Armed Forces. *Prereq: H303.*

H841 ADVANCED ECONOMICS AND PROBLEMS OF DEFENSE PLANNING. *Three Sem Hrs (3-0).* Intermediate level economic analysis, with emphasis on policy problems in war and cold war; production and manpower programing, allocating of materials, stockpiling, wage and price controls, rationing, wartime fiscal and monetary policies. *Prereq: H304.*

H843 CONSTITUTIONAL LAW. *Three Sem Hrs (3-0).* A survey of the basic principles of American constitutionalism. Included in this course are: history of American constitutional development; implementation of separation of powers, federalism, and limited government; development and exercise of national powers, judicial function in constitutional cases; and introduction to civil rights and liberties. *Prereq: H303.*

H845 PUBLIC FINANCE. *Three Sem Hrs (3-0).* The study of all aspects of governmental financial activities and institutions, with emphasis on fiscal and monetary policy. Topics of study include the budget-making process, the role of the Council of Economic Advisers, the function of the Federal Reserve System, and tax policy at all levels of government. Emphasis is on U.S. institutions and practices. *Prereq: H304.*

H846 ECONOMICS OF LABOR RELATIONS. *Three Sem Hrs (3-0).* This course is designed to give the midshipman a general survey of the field of labor relations. A study is made of labor history in the United States, the organization of unions, the economics of the labor market, and the relationship between government and labor. Special attention is given to labor-management relations and current labor problems. *Prereq: H304.*

H848 MONEY AND BANKING. *Three Sem Hrs (3-0).* A systematic study of monetary standards, credit instruments, check clearance, deposit creation, interest rates, currencies, exchange notes, credit policies, and the role of central banks. *Prereq: H304.*

H849 NATIONAL SECURITY POLICY. *Three Sem Hrs (3-0).* A study of the theory and application of strategy and policy formulation and of the interrelationship of foreign and military policies in U.S. national security. It stresses the roles of the intelligence function, diplomatic goals, economic and military capabilities, and of government institutions and agencies in the creation of national policy and strategy. *Prereq: 1/C only or permission of instructor.*

H906 SEMINAR IN NAVAL HISTORY. *Three Sem Hrs (3-0).* Designed to provide opportunity to pursue interest aroused in a phase of naval history. A midshipman, with the supervision of the instructor, will develop his own project of reading or research. The group will discuss oral or written reports submitted at such intervals as will keep discussion fruitful in exploring to a profitable end those problems or aspects of naval history which may be involved. *Prereq: H403.*

H921 SEMINAR IN REPRESENTATIVE CONTEMPORARY NOVELISTS. *Three Sem Hrs (3-0).* Intensive study of selected works of six modern novelists, Moravia, Camus, Silone, Faulkner, Greene, and Malraux, as representatives of contemporary points of view on political, social, and ethical problems of the 20th century. Discussions, collateral readings, reports, individual reading projects. *Prereq: 1/C only or permission of instructor.*

H922 SEMINAR IN REPRESENTATIVE PLAYWRIGHTS. *Three Sem Hrs (3-0).* Intensive study of modern drama, American, British, and continental, as representative of contemporary points of view on the political, social, and ethical problems of the 20th century. Discussion, collateral readings, reports, individual reading projects. *Prereq: 1/c only or permission of instructor.*

H924 SEMINAR IN CRITICAL EVALUATION OF LITERATURE. *Three Sem Hrs (3-0).* Varieties of modern literary criticism: the approaches and uses of critical analysis and evaluation. The major endeavor in the course will be the writing of a substantial critical essay in which the aims and ideals of modern literary criticism are exemplified and the humanistic values of the literature are stressed. *Prereq: 1/C only or permission of instructor.*

H931 SEMINAR IN HISTORY OF TECHNOLOGY. *Three Sem Hrs (3-0).* A survey of the evolution of technology from the time of the Egyptians to the present. Major personalities in the field and significant scientific ideas and events are highlighted through readings, lectures, and seminar discussion. Emphasis is placed on the role of engineering in the development of civilization. *Prereq: 1/C only or permission of instructor.*

H932 SEMINAR IN THE PHILOSOPHY OF WAR. *Three Sem Hrs (3-0).* A survey of the ethical and operational problems involved in war. It provides for the study of the causes and nature of war, an examination of limited and absolute war, and the relationship between military staffs and civil governments, and an analysis of the writings of the leading men on the subject. *Prereq: 1/C only or permission of instructor.*

H933 SEMINAR IN RUSSIAN MILITARY AND NAVAL DOCTRINE. *Three Sem Hrs (3-0).* The evolution of Russian strategic and tactical concepts, the interrelationship of armed services, the development of material, education and training, and illustrative campaigns. Emphasis will be placed upon outstanding Russian formulators and practitioners of military and naval doctrine. The influence of Stalin upon Soviet military doctrine and its differences from conventional concepts are emphasized. A reading knowledge of the Russian language is desirable but not required. *Prereq: 1/C only or permission of instructor.*

H934 SEMINAR IN THE DEVELOPMENT OF UNITED STATES INSTITUTIONS. *Three Sem Hrs (3-0).* This course deals with American institutions and their reciprocal relationships within American society. Institutions to be studied by means of a text, reports, short papers, and roundtable discussion are those affecting politics, economies, social organization, domestic and foreign policy, and intellectual life. Following his interest, the student could, for example, study federalism, political party structure, capitalism, the organization of business and labor, class structure, military structure, educational system, the peace movement, slavery, 19th-century Utopian reform. *Prereq: H631, 632.*

H936 SEMINAR IN THE PHILOSOPHY OF HISTORY. *Three Sem Hrs (3-0).* An analysis of the major schools of historical interpretation from the Hellenic era to Existentialism. Particular attention will be paid to the philosophical and cosmological foundations of historical interpretation, the problems of causality, and the materialist-supernaturalist controversy. Readings and discussions. *Prereq: 1/C only or permission of instructor.*

H937 SEMINAR IN AFRICAN STUDIES. *Three Sem Hrs (3-0).* By the area study method, the political, economic, and social institutions of contemporary Africa are examined and problems are explored.

H938 RESEARCH SEMINAR IN AREA STUDIES. *Three Sem Hrs (3-0).* A detailed analysis of the historic background and current developments of a particular region of the world with reference wherever appropriate, to the objectives of U.S. foreign policy. Much time will be devoted to discussion and examination of basic source materials and to a research paper in the chosen area of study. The areas to be examined include Africa, Europe, Far East, Latin America, and the Middle East. *Prereq: 1/C only or permission of instructor.*

H940 RESEARCH SEMINAR IN HISTORY. *Three Sem Hrs (3-0).* A study of the techniques of historical research with special emphasis upon the problems of authenticity, credibility, and objectivity. There will be investigation of an historical problem and preparation of a research paper based upon this investigation. Each student has the option of working in Naval, European or American History. *Prereq: 1/C permission of instructor.*

H942 RESEARCH SEMINAR IN POLITICS AND ECONOMICS. *Three Sem Hrs (3-0).* A seminar in methodology and types of research materials in either politics or economics, with each student pursuing his own particular interest in a research paper. *Prereq: 1/C only or permission of instructor.*



Jack Engeman

Midshipman in Language Laboratory

Foreign Languages Department

Head of Department: Captain R. S. Hayes; Executive Officer: Lieutenant Commander A. J. DaRodda; Senior Professor: J. D. Yarrow; Professors: A. Cabrillo-Vazquez, C. P. Lemieux, R. F. Muller, H. W. Drexel, P. M. Beadle, A. R. Hefler, W. H. Berry, J. H. Elsdon, and G. J. Riccio; Commander: R. Bahn; Associate Professors: W. H. Buffum, C. R. Michaud, H. R. Keller, C. A. Pritchard, K. E. Lappin, W. W. Sewell, K. P. Roderbourg, J. E. Griffiths, E. J. Satterthwaite, J. A. Hutchins, E. A. DeRosa, R. A. Farley, M. Gutierrez, L. W. Buhrman; Lieutenant Commanders: R. E. Capanema, J. J. Deguines, and T. Ortega; Assistant Professors: S. J. O'Neill, V. S. Tolstoy, R. M. Sanford, and G. H. Koenig.

Mission

This Department provides opportunities for midshipmen to develop proficiency in any of six languages, and to gain significant knowledge of the related foreign areas, peoples, and cultures.

The 1-year required course, L101-102, concentrates on building basic listening and speaking skills. The intermediate course, L201-202, continues emphasis on oral work, develops reading and writing skills, and includes area and cultural topics in conversations and readings. The various advanced courses include

advanced oral and written language, literature, scientific reading, areas and civilizations.

Intermediate and advanced courses are available as single electives, or as part of minor-major sequences. Midshipmen who choose a foreign language for their minor programs will take a total of 24 semester hours in their language (including L101-102). Other midshipmen may take individual languages courses either in place of validated core courses, or as overload electives (if eligible on basis of general grade average).

The major in a foreign language requires a total of 36 semester hours, and may be earned by certain midshipmen who are able to validate basic or intermediate language courses.

Facilities

The Department is equipped with a tape-recording studio, high-speed tape-duplicating facilities, extensive tape libraries, and 4 language laboratories with a capacity of 96 midshipmen for group or individual practice, or for oral testing. Tapes for all lessons are supplied to midshipmen in the basic and intermediate courses, and some 700 tape recorder-playback units are loaned for use in individual midshipmen's rooms in Bancroft Hall.

A variety of tape-recorded material is also available for class or individual use in advanced elective courses in all six languages offered. Visual aids such as sound motion picture films, transparencies, slides, pictures, charts, and maps are used to highlight geographic, cultural, and other background features of the areas and civilizations under discussion.

French Officer Instructor

Jack Engeman



Core Courses

L101-102F	Basic French	L101-102P	Basic Portuguese
L101-102G	Basic German	L101-102R	Basic Russian
L101-102I	Basic Italian	L101-102S	Basic Spanish

Minors Program

French		German	
L201-202F	Intermediate French	L201-202G	Intermediate German
L701-702F	Advanced Written and Oral French	L701-702G	Advanced German
L805-806F	French Area and Civilization	L805-806G	German Area and Civilization
Italian		Portuguese	
L201-202I	Intermediate Italian	L201-202P	Intermediate Portuguese
L701-702I	Advanced Italian	L701-702P	Advanced Portuguese
L805-806I	Italian Area and Civilization	L805-806P	Brazilian and Portuguese Area and Civilization
Russian		Spanish	
L201-202R	Intermediate Russian	L201-202S	Intermediate Spanish
L703-704R	Advanced Russian	L701-702S	Advanced Written and Oral Spanish
L805-806R	Russian Area and Civilization	L807S	Spanish Civilization
		L808S	Spanish-American Civilization

Majors Program

Requirements are 36 semester hours in the same language, including L101-102. Six of these hours are to be selected from optional courses, marked by asterisk.

French		German	
L201-202F	Intermediate French	L201-202G	Intermediate German
L701-702F	Advanced Written and Oral French	L701-702G	Advanced German
L713-714F	Survey of French Literature	L713-714G	Survey of German Literature
L805-806F	French Area and Civilization	*L801-802G	Goethe, Schiller, and Lessing
*L811-812F	Contemporary French Literature	L805-806G	German Area and Civilization
*L813F	The Age of Ideas in French Literature	*L807-808G	German Naval History
*L814F	The Nineteenth Century Novel in France	*L811-812G	German Literature of the Twentieth Century
*L815F	Selected Plays of the French Theater		

Italian		Portuguese	
L201-202I	Intermediate Italian	L201-202P	Intermediate Portuguese
L701-702I	Advanced Italian	L701-702P	Advanced Portuguese
L713-714I	Survey of Italian Literature	L713-714P	Survey of Brazilian and Portuguese Literature
L801I	The Age of Petrarch and Boccaccio	L805-806P	Brazilian and Portuguese Areas and Civilization
L802I	Dante and his Times	L807P	Modern Brazilian Novel
L805-806I	Italian Area and Civilization	L808P	Modern Brazilian Theater
Russian		Spanish	
L201-202R	Intermediate Russian	L201-202S	Intermediate Spanish
L703-704R	Advanced Russian	L701-702S	Advanced Written and Oral Spanish
*L705-706R	The Soviet Press	L713-714S	Survey of Spanish Literature
*L711-712R	Scientific Russian	*L805-806S	Survey of Spanish-American Literature
L713-714R	Survey of Russian Literature	L807S	Spanish Civilization
*L802R	The Nineteenth Century Russian Novel	L808S	Spanish-American Civilization
*L803R	Anton P. Chekhov	*L811-812S	Contemporary Spanish Literature
L805-806R	Russian Area and Civilization		

Course Descriptions

L101-102 BASIC FRENCH, GERMAN, ITALIAN, PORTUGUESE, RUSSIAN, SPANISH. *Three Sem Hrs Each Term (3-0, 3-0).* A foundation course concentrating on development of hearing and speaking skills. Aims at fluency in use of speech patterns exemplifying the basic structures of the language, with control of basic vocabulary and simple phraseology of everyday situations. Basic reading skill is a secondary goal. Writing is limited to material first mastered orally.

L201-202 INTERMEDIATE FRENCH, GERMAN, ITALIAN, PORTUGUESE, RUSSIAN, SPANISH. *Three Sem Hrs Each Term (3-0, 3-0).* Continues emphasis on oral work and mastery of speech patterns; develops reading and writing skills; includes area and cultural topics in conversations and readings. *Prereq: L101-102 or equivalent.*

FRENCH

L701F & L702F ADVANCED WRITTEN AND ORAL FRENCH. *Three Sem Hrs Each Term (3-0, 3-0).* Develops accuracy and ease in the active use of French. Provides ample practice in writing and speaking. Includes vocabulary building and systematic review of gram-



Cannes. Two Reasons for Studying French

mar. Conducted in French. Two terms, but each term may be taken independently. *Prereq: L202F or equivalent.*

L711F & L712F ADVANCED FRENCH READINGS AND CONVERSATION. *Three Sem Hrs Each Term (3-0, 3-0).* Reading and discussion of selected literary works. Includes writing practice. Primarily a course for nonmajors who desire to increase their active ability in French and their knowledge of French culture. Conducted in French. Two terms, but each may be taken independently. *Prereq: L202F or equivalent.*

L713F & L714F SURVEY OF FRENCH LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Comprehensive study of major French works from the Middle Ages to the present, with emphasis on those essential to an understanding of the French character and cultural heritage. Conducted in French. Two terms, but each term may be taken independently. *Prereq: L202F or equivalent.*

L805F & L806F FRENCH AREA AND CIVILIZATION. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussions leading to extensive knowledge and understanding of France and the French people today. Topics include the major aspects of French history, geography, resources, economy, government, institutions, and present-day cultural life. Conducted in French. Two terms, but each term may be taken independently. *Prereq: L202F or equivalent.*

L811 & L812F CONTEMPORARY FRENCH LITERATURE.

Three Sem Hrs Each Term (3-0, 3-0). Reading and discussion of selected works of the most significant modern French authors, including Proust, Gide, Romain, Mauriac, Malraux, Sartre, and Camus. Emphasis given to the social, moral, and intellectual currents influencing French life and attitudes from 1900 to the present. Text analysis, critical discussion, and lectures. Conducted in French. Two terms, but each term may be taken independently. *Prereq: L202F or equivalent.*

L813F THE AGE OF IDEAS IN FRENCH LITERATURE.

Three Sem Hrs (3-0). Study and discussion of French 18th-century thought as expressed in literature. Included are "les philosophes," Montesquieu, Diderot and *l'Encyclopedie*, Voltaire, and Rousseau. Conducted in French. *Prereq: L202F or equivalent.*

L814F THE NINETEENTH CENTURY NOVEL IN FRANCE.

Three Sem Hrs (3-0). Reading and discussion of works of Vigny, Balzac, Stendhal, Flaubert, Zola, and others. Conducted in French. *Prereq: L202F or equivalent.*

L815F SELECTED PLAYS OF THE FRENCH THEATER.

Three Sem Hrs (3-0). Reading and discussion of plays of representative French dramatists including Moliere, Racine, Corneille, Beaumarchais, Hugo, Rostand, Pagnol. Conducted in French. *Prereq: L202F or equivalent.*

GERMAN

L701G & L702G ADVANCED GERMAN.

Three Sem Hrs Each Term (3-0, 3-0). Designed to develop facility and accuracy in the active use of German. Ample practice in writing and speaking. Includes vocabulary building and systematic review of grammar. Conducted in German. Two terms, but each term may be taken independently. *Prereq: L202G or equivalent.*

L713G & L714G SURVEY OF GERMAN LITERATURE.

Three Sem Hrs Each Term (3-0, 3-0). Comprehensive study of major German works of the various periods. Emphasis given to those essential to understanding of German thought and attitudes. Conducted in German. Two terms, but each term may be taken independently. *Prereq: L202G or equivalent.*

L801G & L802G GOETHE, SCHILLER, AND LESSING.

Three Sem Hrs Each Term (3-0, 3-0). Selected works from the three greatest German writers. Their influence on the literature and history of the times will be emphasized. Conducted in German. Two terms, but each term may be taken independently. *Prereq: L202G or equivalent.*

L805G & L806G GERMAN AREA AND CIVILIZATION. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussions designed to provide thorough knowledge and understanding Germany and the German people today. The history of the many nations which make up modern Germany will be discussed. Other topics will include geography, resources, economy, government, institutions, present-day civilization and culture, and Germany's role in current affairs. Conducted in German. The terms, but each term may be taken independently. *Prereq: L202G or equivalent.*

L807G & L808G GERMAN NAVAL HISTORY. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussion of German naval concepts and activities, with emphasis on World War II. This course is designed to broaden the midshipman's knowledge of naval-military history and to give him a better perspective of his chosen profession. From the standpoint of language, the class conversations develop active control of naval-military terminology, as well as standard vocabulary. Conducted in German. Two terms, but each term may be taken independently. *Prereq: L202G or equivalent.*

L811G & L812G GERMAN LITERATURE OF THE TWENTIETH CENTURY. *Three Sem Hrs Each Term (3-0, 3-0).* Study and discussion of literary movements and selected authors: Hauptmann, Mann, Hesse, Borchert, Kafka, Langasser, Wiechert, Schnitzler, von Hofmannsthal, Durrenmatt, and others. Conducted in German. Two terms, but each term may be taken independently. *Prereq: L202G or equivalent.*

ITALIAN

L701I & L702I ADVANCED ITALIAN. *Three Sem Hrs Each Term (3-0, 3-0).* Develops accuracy and ease in the active use of Italian. Provides ample practice in writing and speaking. Includes vocabulary building and systematic review of grammar. Conducted in Italian. Two terms, but each term may be taken independently. *Prereq: L202I or equivalent.*

L713I & L714I SURVEY OF ITALIAN LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Reading and discussion of major works from the pre-Renaissance period to modern times. Emphasis given to works which best exemplify the Italian character and cultural heritage. Conducted in Italian. Two terms, but each term may be taken independently. *Prereq: L202I or equivalent.*

L801I THE AGE OF PETRARCH AND BOCCACCIO. *Three Sem Hrs (3-0).* This course deals with two of the greatest names in Italian and world literature, and the development of poetry and the short story. Conducted in Italian. *Prereq: L202I or equivalent.*

L802I DANTE AND HIS TIMES. *Three Sem Hrs (3-0).* In this course the *Divina Commedia* is read and discussed in the light of the literary, political, and religious ideals of the Middle Ages. Conducted in Italian. *Prereq: L202I or equivalent.*

L805I & L806I ITALIAN AREA AND CIVILIZATION. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussions designed to provide extensive knowledge and understanding of Italy and the Italian people of today. Topics include the major aspects of Italian history, geography, resources, economy, government, institutions, and present-day civilization. Conducted in Italian. Two terms, but each term may be taken independently. *Prereq: L202I or equivalent.*

PORTUGUESE

L701P & L702P ADVANCED PORTUGUESE. *Three Sem Hrs Each Term (3-0, 3-0).* Develops facility and accuracy in the active use of Portuguese. Ample practice in writing and speaking. Includes vocabulary building and systematic review of grammar. Conducted in Portuguese. Two terms, but each term may be taken independently. *Prereq: L202P or equivalent.*

L713P & L714P SURVEY OF BRAZILIAN AND PORTUGUESE LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Reading and discussion of major works which best illustrate the national characteristics, life, and attitudes of the Brazilian and Portuguese peoples. Conducted in Portuguese. Two terms, but each term may be taken independently. *Prereq: L202P or equivalent.*

L805P & L806P BRAZILIAN AND PORTUGUESE AREAS AND CIVILIZATION. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussions designed to provide extensive knowledge and understanding of Brazil and Portugal and their peoples. Topics include the major aspects of Portuguese and Brazilian history, character of populations, geography, economy, governments, institutions, development projects, and cultural life. Conducted in Portuguese. Two terms, but each term may be taken independently. *Prereq: L202P or equivalent.*

L807P MODERN BRAZILIAN NOVEL. *Three Sem Hrs (3-0).* Study and discussion of representative works by contemporary novelists such as Jorge Amado, Graciliano Ramos, Jose Lins do Rego, Rachel de Queiroz, and Erico Verissimo. Conducted in Portuguese. *Prereq: L202P or equivalent.*

L808P MODERN BRAZILIAN THEATER. *Three Sem Hrs (3-0).* Study and discussion of representative plays by Pedro Bloch, R. Magalhaes Junior, Guilherme Figueiredo, and others. Emphasis given to works which best illustrate national characteristics, values, and attitudes. Conducted in Portuguese. *Prereq: L202P or equivalent.*

RUSSIAN

L703R & L704R ADVANCED RUSSIAN. *Three Sem Hrs Each Term (3-0, 3-0).* Review of basic patterns and writing practice continued, with analysis and discussion of standard literary passages. Conversational facility developed by means of discussions, debate, and oral reports. Conducted in Russian. Two terms, but each term may be taken independently. *Prereq: L202R or equivalent.*

L705R & L706R THE SOVIET PRESS. *Three Sem Hrs Each Term (3-0, 3-0).* An introduction to the style and content of the Soviet press. Current Russian publications will be read and analyzed with attention to the selective nature of the Soviet press. In addition to giving insight into current problems of Soviet policy, this course aims to prepare the midshipman for research in the field of Russian and Soviet affairs. Conducted in Russian. Two terms, but each term may be taken independently. *Prereq: L202R or equivalent.*

L711R & L712R SCIENTIFIC RUSSIAN. *Three Sem Hrs Each Term (3-0, 3-0).* An advanced reading course in current Soviet scientific literature. Material selected from periodicals, textbooks, and encyclopedias. Attention given to administrative framework of theoretical and applied research. Conducted in Russian. Two terms, but each term may be taken independently. *Prereq: L202R or equivalent.*

L713R & L714R SURVEY OF RUSSIAN LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Reading and discussion of selections which best illustrate Russian life, character traits, attitudes, and environment. Conducted in Russian. Two terms, but each term may be taken independently. *Prereq: L202R or equivalent.*

L802R THE NINETEENTH CENTURY RUSSIAN NOVEL. *Three Sem Hrs (3-0).* Readings from the works of L. N. Tolstoy, I. S. Turgenev, F. M. Dostoevsky. Reports and discussions in Russian. Conducted in Russian. *Prereq: L202R or equivalent.*

L803R ANTON P. CHEKHOV. *Three Sem Hrs (3-0).* Study of selected plays and short stories of A. P. Chekhov. Objective is to increase mastery of contemporary Russian vocabulary and to develop an understanding of Chekhov's world. Conducted in Russian. *Prereq: L202R or equivalent.*

L805R & L806R RUSSIAN AREA AND CIVILIZATION. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussions designed to provide extensive knowledge and understanding of Russia and the Soviet peoples. Topics include the major aspects of Russian history, character of populations, geography, resources, government, institutions, and cultural life. Conducted in Russian. Two terms, but each term may be taken independently. *Prereq: L202R or equivalent.*

SPANISH

L701S & L702S ADVANCED WRITTEN AND ORAL SPANISH. *Three Sem Hrs Each Term (3-0, 3-0).* Designed to develop facility and accuracy in the active use of Spanish. Ample practice in writing and speaking. Includes vocabulary building and systematic review of grammar. Conducted in Spanish. Two terms, but each term may be taken independently. *Prereq: L202S or equivalent.*

L711S & L712S ADVANCED SPANISH READINGS AND CONVERSATION. *Three Sem Hrs Each Term (3-0, 3-0).* Reading and discussion of selected literary works. Includes some writing practice. Primarily a course for nonmajors who desire to increase their active ability in Spanish and their knowledge of Spanish culture. Conducted in Spanish. Two terms, but each term may be taken independently. *Prereq: L202S or equivalent.*

L713S & L714S SURVEY OF SPANISH LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Reading and discussion of works which best illustrate the Spanish character and personality, attitudes, environment, and cultural heritage. The program includes masterpieces from the various periods with background readings and lectures on the major literary movements. Conducted in Spanish. Two terms, but each term may be taken independently. *Prereq: L202S or equivalent.*

L805S & L806S SURVEY OF SPANISH-AMERICAN LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Readings and discussion of works which best illustrate Spanish-American characters, attitudes, environment, and cultural life. Includes major works from various countries, with background readings and lectures on major literary movements. Conducted in Spanish. Two terms, but each term may be taken independently. *Prereq: L202S or equivalent.*

L807S SPANISH CIVILIZATION. *Three Sem Hrs (3-0).* Readings and discussions on the most significant aspects of Spain's history, people, geography, resources, institutions, and cultural life. Conducted in Spanish. *Prereq: L202S or equivalent.*

L808S SPANISH-AMERICAN CIVILIZATION. *Three Sem Hrs (3-0).* Readings and discussion on the areas and peoples of Spanish America, with emphasis given to major aspects of geography, resources, history, institutions, and customs of selected countries. Conducted in Spanish. *Prereq: L202S or equivalent.*

L811S & L812S CONTEMPORARY SPANISH LITERATURE. *Three Sem Hrs Each Term (3-0, 3-0).* Study and discussion of novels, plays, essays, and poetry which are most representative of Spanish and Spanish-American life and culture since 1900. Conducted in Spanish. Two terms, but each term may be taken independently. *Prereq: L202S or equivalent.*



Mathematics Department

Head of Department: Captain E. E. Mallick; Executive Officer: Commander W. F. Kelly; Senior Professor: L. H. Chambers; Professors: E. E. Betz, R. C. Morrow, A. E. Currier, J. C. Abbott, R. P. Bailey, N. H. Ball, T. J. Benac, J. R. Bland, C. P. Brady, J. E. Hammond, E. Hawkins, J. H. Holme, J. P. Hoyt, G. A. Lyle, J. Milkman, K. L. Palmquist, J. F. Paydon, V. N. Robinson, S. S. Saslaw, W. H. Sears, Jr., H. K. Sohl, H. C. Stotz, G. R. Strohl, Jr., J. A. Tierney; Commanders: G. W. Gibson; Associate Professors: B. H. Buikstra, M. V. Gibbons, J. R. Gorman, E. C. Gras, A. A. Karwath, H. L. Kinsolving, J. F. Milos, R. Molloy, N. O. Niles, M. F. Stilwell, W. J. Strange, E. G. Swafford, O. M. Thomas, C. E. Thompson, J. W. White, H. Wierenga, C. S. Wolf; Lieutenant Commanders/Majors, USMC: R. W. Arn, W. H. Bowling, H. J. Burrows, T. H. Copeman, Jr., M. E. Lewis, W. T. Marin, A. T. McIsaac, R. W. Meissner, A. R. Phillips, O. E. Sanden, Jr., C. E. Caudill; Assistant Professors: C. L. Beall, J. E. Cicero, G. E. Culbertson, D. W. Durland, J. E. Emonds, G. E. Haborak, W. J. Hilderbrand, H. M. Kaplan, J. D. McPherson, D. L. Muench, A. M. Norris, F. P. Prokip, J. P. Yizze, S. Zamosciany; Lieutenants/Captains, USMC: B. A. Clark, W. H. Dawson, D. Fecko, D. H. Gould, R. L. Launer, W. C. A. Sympson, Jr., H. E. Wells; Lieutenants (jg): D. G. Bettis, J. C. Day; Ensigns: R. L. Clark, R. N. Leggett, Jr., C. M. Kilgore.

Mission

The mission of this department is threefold, namely, (1) to teach mathematics as a basic science, (2) to provide midshipmen with a knowledge of fundamental mathematical concepts and (3) to develop a facility for their use in solving practical problems arising in other departments. The basic and elective courses are planned in such a manner as to be of the greatest possible assistance to the midshipmen in their work throughout the professional departments. Development of an analytic approach to problems and an understanding of basic principles involved is stressed throughout the courses taught. In addition to core courses which are required of all midshipmen, there are 24 elective courses offered.

Core Courses

(None) Plane Trigonometry ¹	M211 Calculus III
M111 Calculus I	M220 Differential Equations
M120 Calculus II	M305 Vector Mechanics

¹ For those midshipmen not offering Trigonometry upon entrance.

Minors Program

Mathematics

M601 Matrix Theory	M751 Engineering Mathematics I
One course from:	One course from:
M602 Modern Algebra	M722 Advanced Calculus II
M604 Numerical Analysis	M752 Engineering Mathematics II
M606 Probability and Statistics II	
M671 Linear Programming	Two courses from:
	Mathematics, Science,
One course from:	Naval Science or Engineering.
M721 Advanced Calculus I	

Majors Program

Theoretical Mathematics

M601 Matrix Theory
M602 Modern Algebra
M721 Advanced Calculus I
M722 Advanced Calculus II
Four courses from:
M802 Introduction to Complex Variable
M861 Linear Algebra
M862 Advanced Differential Equations I
M863 Advanced Differential Equations II
M864 Topology
M866 Algebraic Structures

Applied Mathematics

M601 Matrix Theory
One course from:
M602 Modern Algebra

M604 Numerical Analysis
M606 Probability and Statistics II
M671 Linear Programming
Plus:
M721 Advanced Calculus I
M751 Engineering Mathematics I
M825 Methods of Applied Mathematics I
M826 Methods of Applied Mathematics II
Two courses from:
M802 Introduction to Complex Variable
M852 Operational Methods
M861 Linear Algebra
M862 Advanced Differential Equations I
M863 Advanced Differential Equations II
M864 Topology



Jack Engeman

Course Descriptions

PLANE TRIGONOMETRY.* Trigonometric functions; graphs; equations; slide rule solutions of triangles. No credit granted.

M111 CALCULUS I. *Four Sem Hrs (4-0).* Functions of one variable; differentiation and integration; selected topics in analytic geometry; applications.

*For those midshipmen not offering trigonometry upon entrance.

- M120 CALCULUS II.** *Four Sem Hrs (4-0).* Logarithmic and exponential functions; functions of several variables; multiple integrals; selected topics in analytic geometry; applications.
- M211 CALCULUS III.** *Four Sem Hrs (4-0).* Partial differentiation; differentials; chain rule; gradient; series; selected topics in analytic geometry; applications. Probability. Probability; frequency distributions; moments; probability distributions.
- M220 DIFFERENTIAL EQUATIONS.** *Four Sem Hrs (4-0).* Linear differential equations; Laplace Transform; simultaneous differential equations; series solution of differential equations; partial differential equations; Fourier Series; applications.
- M305 VECTOR MECHANICS.** *Three Sem Hrs (3-0).* Vectors; velocity and acceleration components; impulse, momentum, work, energy, conservative forces and potential energy, impulse-momentum, central forces, inverse square law; Kepler's Laws, velocity patterns and reference frames, plane and general motion of a rigid body. Theorem of Coriolis, dynamics of a rigid body.
- M502 FUNDAMENTALS OF MATHEMATICS.** *Three Sem Hrs (3-0).* Logic, the number system, logic of algebra, mathematical induction, cardinal number, groups.
- M601 MATRIX THEORY.** *Three Sem Hrs (3-0).* Algebra of matrices; transformations; bilinear forms; rank; systems of linear equations; quadratic forms; linear vector spaces; determinants; characteristic matrix. *Prereq: M120.*
- M602 MODERN ALGEBRA.** *Three Sem Hrs (3-0).* Fundamental concepts; sets, relations, operations; rings; integers; fields; number fields; rational numbers, real numbers, complex numbers; groups; algebra of matrices. *Prereq: 120.*
- M604 NUMERICAL ANALYSIS.** *Three Sem Hrs (3-0).* Practical solution of algebraic and transcendental equations; finite differences and their applications; numerical integration of initial value problems; numerical integration of ordinary boundary value problems. *Prereq: M120.*
- M606 PROBABILITY AND STATISTICS II.** *Three Sem Hrs (3-0).* Sampling theory; analysis of pairs of measurements; theoretical frequency functions for correlation and regression; the chi-square distribution; small sample theory (student's T and F distribution); general principles for testing hypotheses and for estimation; non-parametric methods. *Prereq: M211.*
- M608 VECTOR ANALYSIS.** *Three Sem Hrs (3-0).* Geometry and algebra of vectors; vector calculus and vector fields; line and surface integrals; Stokes' and Gauss' Theorems; applications. *Prereq: M211.*

M652 VECTOR MECHANICS. *Three Sem Hrs (3-0).* Vectors, velocity and acceleration components, impulse-momentum, work energy, conservative forces and potential energy, momentum, central forces, inverse-square law, Kepler's Laws, velocity patterns and reference frames, plane and general motion of a rigid body, Theorem of Coriolis, dynamics of a rigid body, conservative force fields, equilibrium of fluids, gradient, curl. Stokes' Theorem, divergence, and equation of continuity. *Prereq: M220.*

M671 LINEAR PROGRAMING. *Three Sem Hrs (3-0).* The transportation problem, the simplex algorithm, the dual problem, the final tableau and an introduction to game theory. *Prereq: M601.*

M704 MATHEMATICS FOR ENGINEERS AND PHYSICISTS. *Three Sem Hrs (3-0).* To include topics from: matrix theory; vector analysis; partial differential equations; complex variables. *Prereq: M305 or M652.*

M721 ADVANCED CALCULUS I. *Three Sem Hrs (3-0).* Real and complex number systems, set theory, numerical sequences and series, continuity, differentiation, the Riemann Stieltjes Integral, sequences and series of functions. *Prereq: M220.*

M722 ADVANCED CALCULUS II. *Three Sem Hrs (3-0).* Power Series, Fourier Series, orthogonal functions, functions of several variables, integration. *Prereq: M721.*

M751 ENGINEERING MATHEMATICS I. *Three Sem Hrs (3-0).* Vector analysis; line, surface and volume integrals; Green's Theorem, Stokes' Theorem; Fourier Analysis; partial differential equations, Bessel Function, applications, Legendre Polynomial, differentiation under the integral sign. *Prereq: M305 or M652.*

M752 ENGINEERING MATHEMATICS II. *Three Sem Hrs (3-0).* Laplace Transformation and selected supporting topics from complex variable (analytic functions, residues, etc.). *Prereq: M751 or M722.*

M770 INTRODUCTION TO MATHEMATICAL ECONOMICS. *Three Sem Hrs (3-0).* Simple dynamic models, theory of the multiplier, the acceleration principle, linear difference equations, trade cycle theory, economic regulation and allocation of resources. *Prereq: M601 and permission of the instructor.*

M802 INTRODUCTION TO COMPLEX VARIABLE. *Three Sem Hrs (3-0).* Analytic functions: elementary functions; integrals; series; residues and poles; conformal mapping and applications; analytic continuation; Riemann Surfaces. *Prereq: M721.*

M825 METHODS OF APPLIED MATHEMATICS I. *Three Sem Hrs (3-0).* Programing in Fortran; summation of series, truncation

error; solution of equations by iterative methods; computations associated with matrices; characteristic value problems; interpolation, mechanical quadratures; difference and differential equations. *Prereq: M601 and M721.*

M826 METHODS OF APPLIED MATHEMATICS II. *Three Sem Hrs (3-0).* Review of classical methods for the initial value problem in differential equations; Euler-Cauchy, Adams, Milne; Runge-Kutta Methods; prediction and correction iterations; convergence and stability; deferred iteration; two-point boundary value problems and eigenvalue problems; strong, inherent, and partial instability. Numerical solutions of partial differential equations. *Prereq: M825 and M751.*

M852 OPERATIONAL METHODS. *Three Sem Hrs (3-0).* Application of Laplace and Fourier Transforms to the analysis of the problems of science and engineering involving ordinary differential equations and the boundary value problems of partial differential equations. *Prereq: M802 and permission of instructor.*

M861 LINEAR ALGEBRA. *Three Sem Hrs (3-0).* An abstract treatment of vector spaces and linear transformation with applications to algebra, analysis and geometry. *Prereq: M601, M602, M722 and permission of instructor.*

M862 ADVANCED DIFFERENTIAL EQUATIONS I. *Three Sem Hrs (3-0).* A modern treatment of existence, uniqueness, oscillation and comparison theorems. The theory of stability of solutions. Topological methods. *Prereq: M722 and permission of instructor.*

M863 ADVANCED DIFFERENTIAL EQUATIONS II. *Three Sem Hrs (3-0).* Plane autonomous systems; approximate solutions; stability; regular singular points; Sturm-Liouville Systems; expansions in eigenfunctions. *Prereq: M802, M863 and permission of instructor.*

M864 TOPOLOGY. *Three Sem Hrs (3-0).* Topics to include sets and functions, metric spaces, topological spaces, compactness, separation, connectedness, Stone-Weierstrauss Theorems, and an introduction to Banach and Hilbert Spaces. *Prereq: M601, M602, M721 and permission of instructor.*

M866 ALGEBRAIC STRUCTURES. *Three Sem Hrs (3-0).* Groups; structure theorems; extension fields; elements of Galois Theory. *Prereq: M602 and permission of instructor.*

M902 SCIENCE RESEARCH PROJECT. *Three Sem Hrs (3-0).* A creative, scientific research project in the field of the student's interest, approved by the science research adviser in the department. *Prereq: Permission of Head of Math Department.*

Naval Science Department

Head of Department: Captain J. M. Tully; **Executive Officer:** Commander F. J. Jablonski; **Academic Advisor:** Professor G. J. Mann; **Commanders/Lieutenant Colonels, USMC:** W. Beck, Jr., J. E. Farley, R. Fuller, Jr., C. J. Glauser, N. Mikhalevsky, H. L. Stanfield, R. E. Steed, R. W. Taylor; **Associate Professors:** J. Williams, P. M. Tullier, Jr.; **Lieutenant Commanders/Majors, USMC:** J. B. Andrews, A. F. Cornell, W. T. Crawford, G. A. Fox, Jr., A. C. Friedman, J. E. Geary, J. D. MacKenzie, B. G. Mattox, Jr., R. J. Morin, J. E. Newton, T. N. Olson, W. J. Pototsky, A. W. Rilling, J. S. Rockett, P. Scagliusi, L. H. Snider, E. W. V. Webster, R. F. Wenzel, W. C. Simanikas; **Assistant Professor:** J. H. Dukes; **Lieutenants:** L. J. Bowles, Jr., R. T. Buono, G. B. Chafee, Jr., R. L. Chrans, R. W. Christy, P. Z. Cummins, II, B. S. Dunbar, J. F. Foresman III, L. E. Gessner, L. A. Gilliland, Jr., L. B. Goldstein, J. P. Gower, C. R. Hall, III, C. P. Hammon, C. E. Harris, Jr., D. A. Hartley, J. R. Hooper, Jr., H. C. Ketts, D. E. Lebby, R. W. MacKay, R. J. Madara, L. B. Massey, J. C. McCabe, G. T. McKenzie, C. G. Nolan, H. L. Pabst, T. L. Pasternack, L. S. A. Perry, P. G. Schenk, W. R. Stark, M. A. Stowell, O. L. Woodbury III; **Lieutenants (j.g.):** R. W. Addicott, W. M. Bildhauer, J. E. Burns, Jr., D. P. Chiras, T. C. Davis, Jr., R. D. de la Garza, W. S. Fisher, B. L. Gibbs, A. F. Jackson, J. H. Logie, J. F. Owens, H. E. Rodegerdts, R. A. Schultz, O. F. Thorson, R. S. Webber, E. B. Wintersteen; **Ensign:** J. J. Kelly.

Mission

The mission of the department is to provide midshipmen with the fundamental concepts and principles of naval science and with the professional naval knowledge necessary to establish a sound basis for future growth as naval officers. Academic studies encompass leadership and management, meteorology and oceanography, navigation, naval operations and operations analysis, and sea-power.

Practical applications of all aspects of shipboard operations including leadership as well as seamanship, shiphandling, communications, and shipboard organization are presented throughout the 4 years culminating each spring in multiclass exercises in naval tactics aboard the Naval Academy patrol craft. In addition, shipboard and aviation experience is gained in the summer cruise program. The midshipman is thus developed professionally through classroom academics, study, and practical application for service as a career naval officer.

Facilities

The Naval Science Department is located in Luce Hall, named for Rear Admiral Stephen B. Luce, founder and first President of the Naval War College. In addition to classrooms, Luce Hall contains a large navigation plotting room, a planetarium, and four fully equipped Combat Information Center (CIC) training spaces. The navigation plotting room seats 500 at plotting desks for navigation practical work and examinations.

The *planetarium* is used in teaching astronomy and celestial navigation. With the Spitz A-3-P projector and associated auxiliary projectors, it is possible to simulate the sky as it would appear from any point on earth, at any time of day or night. The complete sequence of events leading to the determination of position at sea by use of the stars, sun, moon, and planets can be portrayed with this device.

During the winter months instruction in tactical doctrine and procedures is carried out in the *CIC training rooms*. Advanced tactical procedures in anti-submarine and anti-air-warfare situations are covered. Full-scale fleet tactical exercises can be simulated in the CIC's, including voice radio communications, radar presentations, air raids, and tactical plots to evoke command decisions.

Instruction in shipboard operations and evolutions is conducted on board the Naval Academy's *Yard Patrol Craft*, commonly called YP's. These 80-foot diesel-powered ships are exceptionally well equipped to provide training and instruction in seamanship, navigation, communications, and tactics. With the arrival of spring, plebes and upperclassmen join in "Operation Seabreeze" on board the YP's. "Seabreeze" is a series of advanced tactical exercises which combine all elements of the 4 years of professional education. The plebes perform the functions of helmsman, lookout, signalman, and telephone talker. Second Classmen serve as members of the CIC Team. The First Classmen serve as officers in command and control positions.

Training Aboard Academy's Yard Patrol Craft

Jack Engeman



Core Courses

N105	Air-Ocean Environment	N315	Naval Operations Analysis I
N106	Introduction to Psychology and Management	N316	Naval Operations Analysis II
N206	Navigation	N409	Management and Military Law

Minors Program

Management			
N609	Psychology: Individual Differences	N705	Ocean Waves, Tides, and Ice
N610	Principles of Management	N708	Synoptic Meteorology
N701	Financial Management	N814	Oceanographic Applications
N702	Material Management	N821	Nearshore Oceanography
N813	Personnel Administration	Operations Analysis	
H844	Advanced Economics and Problems of Defense Planning	M601	Matrix Theory
Oceanography		M606	Probability and Statistics
N603	Oceanography	N707	Games of Strategy
N607	Meteorology	N710	Decision Theory
		N823	Methods of Operations Analysis
		N824	Applications of Operations Analysis

Majors Program

Management			
M601	Matrix Theory	N705	Ocean Waves, Tides, and Ice
M606	Probability and Statistics	S722	Theoretical Physics II
N609	Psychology: Individual Differences	M721	Advanced Calculus I
N610	Principles of Management	M722	Advanced Calculus II
N701	Financial Management	N821	Nearshore Oceanography
N702	Material Management	N826	Oceanographic Applications
W707	Digital Computers	N828	Oceanography Laboratory
N813	Personnel Administration	Operations Analysis	
N816	Decision Theory	M601	Matrix Theory
N822	Advanced Case Studies in Management	M606	Probability and Statistics
H844	Advanced Economics and Problems of Defense Planning	M671	Linear Programming
H845	Public Finance	N706	War Gaming
H846	Economics of Labor Relations	M770	Mathematical Economics
Oceanography		N808	Naval Strategy and Military Planning
N603	Oceanography	N811	Games of Strategy
M606	Probability and Statistics	N816	Decision Theory
N607	Meteorology	N823	Methods of Operations Analysis
M608	Vector Analysis	N824	Applications of Operations Analysis
S609-610	General Biology or	H844	Advanced Economics and Problems of Defense Planning
S611-612	General Geology	N906	Operations Research Project
S721	Theoretical Physics I		



Getting Underway From Academy

Marlinspike Seamanship



Course Descriptions

N105 AIR-OCEAN ENVIRONMENT. *Three Sem Hrs (3-0).*

An orientation course introducing the effects of the natural environment on naval operations. A broad description of the environmental properties of the ocean and atmosphere including the topographic and biological characteristics of the sea. Incorporates the study, in descriptive form, of the interrelationships of the two environments stressing the effects of heat balance, turbulence and circulation systems; application of environmental effects of currents, tides, and winds.

N106 INTRODUCTION TO PSYCHOLOGY AND MANAGEMENT. *Three Sem Hrs (3-0).*

Instruction in the fundamental principles of psychology and human behavior with emphasis on the relevance of these principles to the practices of Naval Leadership. Instruction in the basic principles of management and organization with discussion of the procedures and techniques of applying human relations principles to Naval Management.

N206 NAVIGATION. *Four Sem Hrs (3-2).*

Instruction in piloting and introduction to celestial navigation. Includes techniques of visual, radar, and of navigational aids; and definition of tactical characteristics. Introduction to nautical astronomy, star identification, navigational triangle, celestial coordinate systems, concepts of time, theory of celestial navigation, and elementary celestial plotting.

N315 NAVAL OPERATIONS ANALYSIS I. *Three Sem Hrs (3-0).*

The application of operations analysis techniques to the solution of naval warfare problems. An understanding is gained as to the methods used in the development of the basic tactics described in ATP-1(A). Topics include: probability theory, detection theory, radar detection, search theory, sweep width, mean free path theorem, and analytical solutions to specific naval air, surface, and submarine operational problems.

N316 NAVAL OPERATIONS ANALYSIS II. *Three Sem Hrs (3-0).*

A continuation of Naval Operations Analysis I. Topics include: reliability of electronic equipment, antiair warfare, antisubmarine warfare, measures of effectiveness, current operations analysis techniques such as game theory, linear programming, and queuing theory.

N409 MANAGEMENT AND MILITARY LAW. *Three Sem Hrs (3-0).*

The course in military law covers those aspects of military justice and international law which are of most use and importance to a junior officer. Group discussion and case study methods are used to analyze current leadership and management situations with emphasis on self-development and individual responsibility.

N602 ASTRONOMY. *Three Sem Hrs (3-0).* A descriptive course designed to give an appreciation of the universe and to develop interest in interplanetary navigation and space travel. Two aspects of modern astronomy receive particular emphasis. First, the tools and methods employed in the measurement and reduction of astronomical observations to sound conclusions, and second, those elements of astronomy which are related to our modern-day experiments in space. *Prereq: S201.*

N603 OCEANOGRAPHY. *Three Sem Hrs (3-0).* An introduction to the basic concepts of oceanography encompassing the subjects of marine geology, biology, chemistry and physical oceanography. Geological topics include: origin, form, and structure of the ocean basins and margins; geomorphic features; and marine sediments. The biomass will be examined in terms of its classification, distribution, nutrient cycles, and its interaction with the physical, chemical, and geological aspects of the ocean. Chemical topics will include composition of sea water, relative proportions, dissolved gases, and the carbonate system. Physical oceanography will be introduced by a study of the physical properties of sea water and their distribution, water masses, and an elementary consideration of forces and motion in the ocean. The interdisciplinary nature of oceanography will be stressed throughout.

N607 METEOROLOGY. *Three Sem Hrs (3-0).* A course to acquaint the student with the basic principles of meteorology. Topics will include structure and composition of the atmosphere, weather elements, instruments and observations, and the structure of air masses, fronts, and storms. The physical principles governing the heat budget, the equations of motion, stability, turbulence, and mixing will be discussed with particular attention given to assumptions and limitations. Atmosphere-sea interactions will be emphasized throughout. *Prereq: N603.*

N609 PSYCHOLOGY: INDIVIDUAL DIFFERENCES. *Three Sem Hrs (3-0).* A study of the sources, measurement and utilization of individual differences. Building upon the general universality of the principles of psychology studied in basic psychology, this course examines the interaction of the physiological, social, cognitive and situational factors that make each man a unique person. In addition to a more comprehensive study of the areas covered in the basic curriculum, emphasis will be placed upon measurement and statistics, testing, adjustments, attitudes, group dynamics and the physiological basis of behavior. *Prereq: N106*

N610 PRINCIPLES OF MANAGEMENT. *Three Sem Hrs (3-0).* The essential principles of management are presented around the concept that management is a process applicable in many enterprises including the military. Included are the topics of case study analysis,

human relations, functions of management (planning, organizing, directing, coordinating, and control), supervision and evaluation with military applications.

N701 FINANCIAL MANAGEMENT. *Three Sem Hrs (3-0).* An introductory course in the basic fundamentals of accounting concepts. Attention is focused on the principles which underlie the construction of financial statements and their use in management control and business decisions. The course is concluded with a survey of the generation of the Federal budget and the Federal accounting process. The role of the military executive as a financial manager is emphasized throughout. *Prereq: N610.*

N702 MATERIAL MANAGEMENT. *Three Sem Hrs (3-0).* An introductory course into the various areas of material management. Emphasis is given to concepts of requirements, determination, procurement and contract administration, maintenance programs, and inventory control. Study is also made of the organization and the functions of those activities of the Department of Defense in the material management field. The role of the line officer in effective material management is stressed throughout. *Prereq: N610.*

N705 OCEAN WAVES, TIDES, AND ICE. *Three Sem Hrs (3-0).* The basic consideration of classical water wave theory as contrasted with the modern statistical approach to waves. Relationships between wind and sea surface phenomena, swell, breakers, internal waves, astronomic tides, tidal currents, seiches, meteorologic tides and tsunami will be examined along with the formation, melting, and movement of ice. *Prereq: N603, N607.*

N706 WAR GAMING. *Three Sem Hrs (3-0).* Various war gaming techniques will be examined in detail from both descriptive and analytical viewpoints. Emphasis will be placed on the use of digital computers in the analysis of military problems, using war gaming techniques. A basic undertaking of the course will be the preparation by each student of a simple war game adaptable to solution by computer using supporting techniques to be taught in the classroom (e.g., Monte Carlo Method, selection of random numbers, probability distributions, etc.). *Prereq: M606.*

N707 GAMES OF STRATEGY. *Three Sem Hrs (3-0).* This course is the same as N811 but is taught at a less rigorous level. *Prereq: M601.*

N708 SYNOPTIC METEOROLOGY. *Three Sem Hrs (3-0).* The study of atmospheric systems on a synoptic scale. Elements of map analysis and forecasting from the marine viewpoint. Motion and evolution of weather systems; relationship of upper flow to surface systems. Storms at sea. *Prereq: N607.*

N710 DECISION THEORY. *Three Sem Hrs (3-0).* This course is the same as N816 but is taught at a less rigorous level. *Prereq: M606.*

N805 MILITARY PSYCHOLOGY II. *Two Sem Hrs (2-0).* The sociology of military life studied through the basic psychological factors of cognition, motivation and interpersonal response traits, social attitudes, their nature and formation; the social and cultural habitat of man in terms of language, communication and origins of culture; leadership groups, military organizations as social systems; and individual role behavior and personality in military groups. *Prereq: N605.*

N806 ADVANCED NAVIGATION. *Three Sem Hrs (3-0).* A study and assessment of the art and skill of navigation, past, present, and future. The history of navigation; specialized theory and techniques, including the sailings, chart and grid design, electronic systems, polar navigation, lifeboat navigation, inertial navigation systems, navigational satellite systems and an introduction to astronautics. *Prereq: N301.*

N808 NAVAL STRATEGY AND MILITARY PLANNING. *Three Sem Hrs (3-0).* The interrelationship of naval strategy, national strategy, policy, and current international situations and commitments. The strategic effect of naval operations; naval force levels; economic and ecological factors affecting the employment of naval power. Detailed study of military planning; the intelligence process; national and naval estimates, etc. *Prereq: Basic curriculum through 3/C year.*

N811 GAMES OF STRATEGY. *Three Sem Hrs (3-0).* A study of the mathematical structure of game theory as a whole, with emphasis on the solution of two person zero-sum games. The nature of various decision criteria is examined in detail and the subject of utility theory is introduced. The entire course is taught in the framework of military application. *Prereq: M601.*

N813 PERSONNEL ADMINISTRATION. *Three Sem Hrs (3-0).* The broad areas of personnel management are covered. The areas of recruitment, selection, placement, training, promotion and evaluation are covered by comparing civilian industrial organizational practices with military methods in the same areas. Emphasis is focused on the topics most directly applicable to the military profession. *Prereq: N610.*

N814 OCEANOGRAPHIC APPLICATIONS. *Three Sem Hrs (3-0).* The principles and relationships developed in preceding oceanography courses will be applied to practical problems of interest to the Navy. It will include analysis and application of oceanographic factors relating to anti-submarine, mine, and amphibious warfare. The subject of ice forecasting, marine fouling, and optimum ship routing also will be covered. *Prereq: N821.*

N816 DECISION THEORY. *Three Sem Hrs (3-0).* Principles used in decision making; utility and descriptive statistics, applications to fair bets; uncertainty due to ignorance of the state of nature; Bayes strategies and supporting lines; computation of Bayes strategies; models of probability and utility. Naval applications in the areas of operational planning and command decision. *Prereq: M606.*

N821 NEARSHORE OCEANOGRAPHY. *Three Sem Hrs (3-0).* A study of the shallow water environment. Topics include: geology of the continental shelves; types and formations of coastlines; shallow water sediments; beaches and beach features; swell, surf and wave refraction; the littoral biomass, and studies of harbors, river mouths, and estuaries with particular reference to mixing and flushing. *Prereq: N603, N607.*

N822 ADVANCED CASE STUDIES IN MANAGEMENT. *Three Sem Hrs (3-0).* An analysis in depth of actual problems confronting commercial and military organizations in the field of management with emphasis on the utilization and application of the principles and techniques developed in the basic curriculum. Effort will be directed toward identifying the problem, developing alternative courses of action and the determination of recommended solutions. *Prereq: N701, N702, N813.*

N823 METHODS OF OPERATIONS ANALYSIS. *Three Sem Hrs (3-0).* A study of the concepts, technical terms, and tasks of Operations Analysis; organizing investigations; collection and evaluation of data. A study of the techniques and typical problems of Operations Analysis such as linear and dynamic programming, queuing theory, decision theory and criteria, sequential analysis, networks, allocation problems, inventory problems, game theory and war gaming. Examples are taken from Naval applications. *Prereq: M601, M606, N316.*

N824 APPLICATIONS OF OPERATIONS ANALYSIS. *Three Sem Hrs (3-0).* Presentation of a selection of reports from current literature, primarily Operations Evaluation Group Studies in the naval warfare areas. Illustrates in greater detail the methodologies of Operations Analysis. Studies include problems in the areas of anti-submarine warfare, anti-air warfare, strike operations, mine warfare, and logistics. *Prereq: N823.*

N826 OCEANOGRAPHIC APPLICATIONS. *Three Sem Hrs (3-0).* Application of the principles and methods of oceanography and meteorology to naval operations and problems. Topics include: elements of weather forecasting; surf forecasting; avoiding storm damage; optimum track ship routing; oceanographic factors in ASW, amphibious and mine warfare oceanographic forecasts; and the



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ASWEPS (Anti-Submarine Warfare Environmental Prediction System) program. *Prereq: N705, N821.*

N828 OCEANOGRAPHIC LABORATORY. *Three Sem Hrs (3-0).* This course is the laboratory support for Course N826. Laboratory practice will parallel the lecture topics of N826. In addition, practice will be provided with oceanographic and meteorological instruments and observations. Field trips will be included to the Oceanographic Office, Oceanographic Data Center, Oceanographic Instrumentation Center, and Naval Weather Central, Suitland. *Prereq: N826 (concurrently).*

N906 OPERATIONS RESEARCH PROJECT. *Three Sem Hrs.* An individual, objective, analytical study in depth of a current problem in Naval Operations. The student, under guidance of an adviser, undertakes solution of a problem susceptible to methods of Operations Research. *Prereq: Consent of Head of Naval Science Department.*

Science Department

Head of Department: Captain C. H. Bowen, Jr.; **Executive Officer:** Commander W. R. Colegrove; **Senior Professor:** E. J. Cook; **Professors:** R. E. Alley, Jr., H. H. Baker, J. L. Daley, R. A. Goodwin, G. D. Gutsche, J. F. Kelley, Jr., J. A. Lee, Jr., G. E. Leydorf, H. F. Maling, Jr., E. D. Pinkston, D. G. Sheets, W. M. Smedley, J. R. Smithson; **Commanders:** R. G. Aldrich, W. E. Clarke, M. Eckhart, Jr., O. K. Hallam, P. A. Phelps, P. H. Thom, Jr., T. H. Wilson; **Associate Professors:** S. A. Elder, C. A. Fowler III, F. J. Gomba, B. J. Graham, E. D. Hall, D. L. Hathway, W. K. Kay, J. H. Klein, R. Q. Macleay, B. H. Morgan, H. M. Neustadt, Jr., D. A. Nordling, M. M. Oldham, W. D. Pennington, R. R. Ressler, O. W. Rollins, L. R. Schweizer, J. C. Thompson, J. R. Wiebush, J. G. Zimmerman; **Lieutenant Commanders/Majors, USMC:** W. P. Albers, R. W. Case, J. E. Criner, D. D. DeWitt, M. L. Duke, L. A. Dwyer, D. D. Eddy, F. M. Fleeman, P. Goslow, R. M. Gowing, R. G. Hollenbach, D. T. Holly, Jr., R. P. Inman, E. A. Jacobs, R. C. Miller, J. W. Peterson, A. H. Rice, E. M. Rudzis, T. B. Sutherland, C. G. Wheeler, R. V. Wilson, Jr., F. T. Woodall, Jr.; **Assistant Professors:** W. J. Bates, D. W. Brill, G. L. Buckwalter, K. W. Chester, R. A. Colclaser, A. E. Conord, F. J. Eberhardt, W. E. Fasnacht, J. J. Gilheany, R. L. Johnston, E. Koubek, E. R. Laste, Jr., H. S. Markham, Jr., J. V. Prestia, P. L. Quinn, D. Wall; **Lieutenants/Captains, USMC:** M. D. Cerreta, Jr., W. R. Curtis, J. A. Gillis, Jr., G. T. Hageseth, R. W. Hill, L. M. Ishol, M. A. Johnson, Jr., J. L. Lightstone, C. V. McNeece, A. Mills, N. A. Palermo, D. K. Rathbun, B. T. Sheehan, W. G. Steadman III, J. A. Ward; **Instructors:** J. F. Hollywood, Jr., W. L. Zedaker; **Lieutenants (j.g.):** G. L. Ehrens, J. W. Ehrmantraut, H. A. Elder, T. R. Irey, G. C. Rappe, R. M. Speights, Jr., D. L. Weingartner; **Ensigns:** D. J. Chadwick, L. W. Sherrill.

Mission

The mission of this department is to impart basic concepts and theories, together with appropriate applications, of the physical, life, and earth sciences. A study of the fundamentals of the sciences is pursued throughout the 4 years of the curriculum. While a familiarity with present-day devices is a necessity, even more important is an understanding of the fundamental principles to which past, present, and future devices owe (or will owe) their existence. Midshipmen are given a realization that progress depends upon a mastery of basic truths, and that, as naval officers, they are being prepared to direct the development and use, not only of the accomplished results of the sciences, but of future possibilities.

The department is equipped with laboratories in chemistry, physics, biology, electrical engineering, and electronics. Midshipmen perform laboratory experiments for a minimum of 2 hours every week of the 4-year course. Classroom instruction is supplemented by periodic demonstration lectures and testing. In addition to core courses, required of all midshipmen, the department offers 52 electives.

Facilities

CHEMISTRY

Basic General Chemistry Course: Six laboratories arranged in pairs, 18 stations per laboratory, 4 feet of working space per station; 3 balance rooms, 18 balances in each, located between the paired laboratories; 1 large general preparation room and stockroom; 1 double-section (36 men) lecture demonstration room; services in all laboratories, including water, gas, distilled water from automatic still; 2 flexible electrical circuits supplied from a central distribution panel to supply any desired AC or DC voltage; and a hood with independent exhaust fan in each laboratory.

Elective Chemistry Courses: One organic chemistry laboratory, 24 stations; 1 physical chemistry laboratory, 16 stations; and 1 preparation room between the organic and physical chemistry laboratories.

There are also three small research laboratories for use by faculty and students.

PHYSICS

Six laboratories are equipped for experiments in general physics. In each laboratory there are eight stations, designed for two students per station. Storage of equipment is provided within the laboratory where practicable.

One small laboratory is equipped for the course in atomic and nuclear physics and another for the course in laboratory physics. There is a nuclear counting installation, including a Cerenkov detector used with a liquid scintillation system, and a multi-channel pulse-height analyzer.

A small research room and a darkroom are available for use by faculty and/or students. The physics library consists of approximately 500 volumes.

ELECTRICAL SCIENCE

Electrical Circuits Laboratory: *Capacity:* 48 work stations, 2 midshipmen per station; *Station Outfit:* Oscilloscope, AC vacuum voltmeter, multimeter, various special meters; *Power Supplies:* Adjustable, regulated DC: 0 to 300 v. —150 to 100 v, and variable AC (60 cps); *Signal System:* All test signals generated in a central system and distributed to work stations on shielded lines.

Electronics Laboratory: *Capacity:* 38 work stations, 2 midshipmen per station; *Station Outfit:* Oscilloscope, AC vacuum tube voltmeter, DC ammeters and voltmeters; *Power Supplies:* Adjustable, regulated DC: 0 to 20 v; variable AC (60 cps); *Signal System:* Similar to Electrical Circuits Laboratory.

Electrical Machinery Laboratory: *Capacity:* Variable, 30–40 stations, depending on particular machine arrangement in use; *Station Outfit:* DC and AC (single and three-phase) machines plus meters and instruments are required.

Core Courses

S101 Chemistry I
S102 Chemistry II
S104 Physics I
S203 Physics II

S206 Modern Physics
S305 Introduction to Electrical Science
S306 Applications of Electrical Science

Minors Program

Chemistry		Electrical Science <i>(continued)</i>	
S605	Organic Chemistry I	S741	Electronics
S606	Organic Chemistry II	S840	Network Analysis
S713	Adv. Inorganic Chemistry I	S841	Energy Conversion
S714	Analytical Chemistry I	S842	Solid State
S811	Physical Chemistry I	S843	Digital Techniques
S812	Physical Chemistry II		
Physics		Nuclear Science	
S701	Atomic Physics	E701	Physical Metallurgy
*S702	Nuclear Physics	or	
S721	Theoretical Physics I	E203	Strength of Materials
S722	Theoretical Physics II	E708	Heat Transfer
S821	Theoretical Physics III	or	
S822	Theoretical Physics IV	S730	Introductory Physical Chemistry
*S830	Physics of Solids	M751	Engineering Math I
Electrical Science		M752	Engineering Math II
M802	Complex Variables	S827	Nuclear Science I
		S828	Nuclear Science II

Majors Program

Chemistry		Physics	
S605	Organic Chemistry I	S204	Physics III
S606	Organic Chemistry II	S701	Atomic Physics
S713	Advanced Inorganic Chemistry I	*S702	Nuclear Physics
S714	Analytical Chemistry	S721	Theoretical Physics I
S811	Physical Chemistry I	S722	Theoretical Physics II
S812	Physical Chemistry II	S723	Lab Physics I
S813	Qualitative Organic Analysis	S724	Lab Physics II
S814	Quantitative Analysis II	S821	Theoretical Physics III
S815	Advanced Inorganic Chemistry II	S822	Theoretical Physics IV
S816	Biochemistry or	S823	Lab Physics III
S818	Catalysis or	S824	Lab Physics IV
S820	Electrochemistry	S825	Physics Seminar I
		S826	Physics Seminar II
		*S830	Physics of Solids
		M715	Engineering Math I
		M752	Engineering Math II

***Note:** Only one of these courses is required to complete the major or minor listed.



Course Descriptions

S101 & S102 CHEMISTRY. *Four Sem Hrs Each Term (3-2).* Fundamentals of chemical theory with a study of the properties of metals and nonmetals. Among specific topics studied in chemical theory are the laws of chemical change, atomic structure and the periodic table, kinetic-molecular theory and the gas laws, solutions, chemical equilibrium, ionization, electrochemistry, radioactivity, nuclear reactions, and nuclear energy from fission and fusion reactions. Metals studied include the alkali and alkaline earth metals, aluminum, and iron. Nonmetals studied are limited to oxygen, hydrogen, halogens, nitrogen, and sulfur families, carbon and simple carbon compounds. Practical naval applications include batteries, corrosion, water treatment, explosives, chemical warfare, the atomic bomb, the hydrogen bomb, and nuclear power plants for propulsion. Laboratory work includes both descriptive and quantitative experiments, and a brief introduction to the principles of semimicro qualitative analysis applied to a few of the more common cations.

S104 GENERAL PHYSICS I. *Four Sem Hrs (3-2).* The first course in general physics consists of three 50-minute recitations and a 2-hour laboratory period each week. Emphasis is placed upon the fundamental principles of classical physics; however, contemporary applications of these principles are introduced as appropriate. The topics covered during this term are mechanics, wave motion, and sound. The calculus, which is scheduled concurrently, is used throughout the course. *Prereq: S101, M111.*

S203 GENERAL PHYSICS II. *Four Sem Hrs (3-2).* The second course in general physics begins with static electricity and Gauss' Law and continues through Ohm's Law, and the laws of Faraday and Lenz. Circuitry is deferred to a later course. Geometrical optics is studied in some detail and physical optics is introduced. *Prereq: S104.*

S204 GENERAL PHYSICS III. *Four Sem Hrs (3-2).* The third course in general physics is designed to complete the coverage of introductory physics for those midshipmen who have elected physics as a field of concentration. Topics such as fluid mechanics, heat, and portions of electricity and light which were omitted from General Physics I and II, will be studied, and the fundamental ideas of quantum physics will be developed. *Prereq: S203.*

S206 MODERN PHYSICS. *Three Sem Hrs (3-0).* This course is a survey of the significant discoveries and developments which have marked the progress of physics during the first half of the 20th century. Some of the topics considered are: the Rutherford-Bohr atom; quantum and relativistic effects; the structure of many-electron atoms; particle ranges, absorption, and detection; radioactivity; the neutron; nuclear forces, and nuclear reactions. *Prereq: S203.*

S305 INTRODUCTION TO ELECTRICAL SCIENCE. *Four Sem Hrs (3-2).* R-L-C circuits are studied in the context of laws, electrical properties, and energy relationships as introduced in Physics. To this end, steady-state treatment and phasor representation are preceded by extensive utilization of classical solution methods. Basic network theorems. Graphical analysis of nonlinear resistive circuits. Principles of ammeter, voltmeter, and oscilloscope are presented to permit development of basic measurement skills in the laboratory. *Prereq: S203, M211.*

S306 APPLICATIONS OF ELECTRICAL SCIENCE. *Four Sem Hrs (3-2).* Elements of active device and machine theory oriented to the control function: vacuum tube characteristics, rectification, triode amplifier, feedback, motor and generator theory. Elements of analog and digital computation. *Prereq: S305, M220.*

S605 & S606 ORGANIC CHEMISTRY. *Five Sem Hrs Each Term (3-6).* A study of the principles of organic chemistry, including the fundamental concepts of energy relationships, resonance, dipole moments, ionic character in covalent bonds and relative electronegativities of atoms and radicals, and the newer areas of organic chemistry including, for example, high energy fuels, synthetic motor fuels, explosives, synthetic rubber and high polymers, detergents and "wonder" drugs. Three lectures and two 3-hour laboratories. *Prereq: S102.*

Hrs (3-0). The course in the development of physical theory is primarily a nonmathematical survey of the evolution of some basic physical concepts. Emphasis is placed upon historical development, influence of philosophy, and considerations of alternate formulations. The whole range of physics will not be covered, but rather a few ideas will be studied in some detail. Examples are the conservation of energy, electric charge, temperature and heat, and formulation of the laws of motion. *Prereq: S104.*

S609 & S610 GENERAL BIOLOGY I AND II. *Four Sem Hrs Each Term (3-2).* A study of the fundamental principles of the various fields of biology, beginning with the characteristics and behavior of protoplasm and cells; general plant and animal histology; plant and animal metabolism; cell gametogenesis and cell division. The principles of genetics and eugenics; ecology; organic evolution. *Prereq: S102.*

S611 & S612 GENERAL GEOLOGY I AND II. *Three Sem Hrs Each Term (3-0).* A study of the science of the solid earth, including the study of the chemical, physical, and biological processes that form the minerals and rocks; stratigraphy and structural geology. Historical geology, development of the geological features of the surface, and interior of the earth; glaciation. *Prereq: S102, S104.*

S620 ELECTRICAL CIRCUIT PRINCIPLES. *Four Sem Hrs (3-2).* Application of Maxwell's Equations in integral form to simple circuits as the basis for volt-ampere circuit analysis. Time-domain analysis of R-L-C circuits: energy relationships, natural response, forced response to a variety of nonsinusoidal driving functions, derivation of phasor and impedance concepts. Steady-state response of R-L-C circuits and inductively coupled circuits. Ideal transformer. Waveform analysis, meter, and oscilloscope principles, and measurement considerations incorporated in topical coverage in support of lab work which will be directly related to basic theory on a week-to-week basis. *Prereq: S203, M211.*

S701 ATOMIC PHYSICS. *Three Sem Hrs (3-0).* The course in atomic physics presents the theory of relativity and the basic theory of quantum mechanics and applies these to the theory of fundamental atomic processes. Included are the quantum theory of radiation, atomic structure, the detailed analysis of the one-electron system, fine structure; addition of angular momenta and multielectron systems, periodic system of elements, X-ray phenomena, and molecular spectra. *Prereq: S206.*

S702 NUCLEAR PHYSICS. *Three Sem Hrs (3-0).* The course in nuclear physics is a study of the basic experimental facts pertaining to those phenomena which are purely nuclear in origin, and their interpretation in terms of contemporary quantum theory to obtain a coherent understanding of the nuclear force problem. Included subjects are: basic nuclear properties, interaction of radiation with matter, nuclear instruments, nuclear reactions, nuclear structure, elementary structure, and elementary particles. *Prereq: S701.*

S704 PRINCIPLES OF UNDERWATER ACOUSTICS. *Three Sem. Hrs (3-0).* Underwater acoustics is a study of the basic principles of acoustics and the application of these principles to underwater sound problems. Topics will include oscillations, plane and spherical waves, radiation patterns, reflection coefficients, attenuation, velocity, ray theory, wave theory, scattering, reverberation, fluctuations, echo ringing, and noise. *Prereq: S203.*

S705 SONAR. *Three Sem Hrs (3-0).* Pulse modulation, signal processing, correlation techniques, transducers. Study of generalized sonar system plus modern techniques in both active and passive modes: bottom-bounce, convergence zone, high resolution methods. *Prereq: S704.*

S710 ELECTROMAGNETIC WAVES. *Three Sem Hrs (3-0).* The course proceeds from a study of electric and magnetic fields, in which vector analysis is employed, to a consideration of Maxwell's equations and the radiation of electromagnetic waves. Boundary conditions and the propagation phenomena of reflection, refraction, inter-

ference, and diffraction are treated in some detail, and wave guides, transmission lines, and radiating systems are introduced. *Prereq: S203, M220.*

S713 ADVANCED INORGANIC CHEMISTRY. *Three Sem Hrs (3-0).* A study of the fundamental concepts of inorganic chemistry. Topics to be covered will include the following: atomic binding forces; complex ions and coordination compounds; reactions in aqueous and nonaqueous media; radioactivity and nuclear transformations. *Prereq: S102.*

S714 ANALYTICAL CHEMISTRY I. *Four Sem Hrs (2-6).* This course involves a study of volumetric, gravimetric, and modern optical and electrical methods of analyses. Theory, laboratory procedures and techniques are stressed. Two recitations and two 3-hour laboratory periods per week. *Prereq: S102.*

S721 THEORETICAL PHYSICS I. *Three Sem Hrs (3-0).* Mechanical vibrations and waves. The first part of a four-part sequence in theoretical physics considers first a study of mechanical oscillators: damped, driven, linear and nonlinear, and coupled. The wave equation is then derived for one-, two-, and three-dimensional systems. Solutions of the wave equation under various boundary conditions and propagation of waves through material media are studied in some depth. Illustrations and problems are drawn largely from acoustics. The mechanics of LaGrange and of Hamilton are also presented. *Prereq: S206.*

S722 THEORETICAL PHYSICS II. *Three Sem Hrs (3-0).* Electromagnetic theory. In the second part of the theoretical physics sequence, the basic principles of electric and magnetic fields are expressed in vector form. Electrostatic problems are considered first using Laplace's and Poisson's equations. The vector potential and the displacement current are introduced and Maxwell's Equations are formulated. From this the wave equation, the Poynting Vector, retarded potentials, and radiation follow. *Prereq: S721.*

S723 LABORATORY PHYSICS I. *One Sem Hr (0-2).* The laboratory work in this course is devoted to physical measurement techniques, the statistical treatment of data, and data presentation. The experiments in mechanical oscillations are closely related to the theory developed in the concurrent course in theoretical physics (S721). *Prereq: S206.*

S724 LABORATORY PHYSICS II. *One Sem Hr. (0-2).* The laboratory work consists of electric and magnetic field measurements. *Prereq: S723.*

S730 INTRODUCTORY PHYSICAL CHEMISTRY.* *Three Sem Hrs (3-0).* A one-semester introduction to the study of the

*A brief course for those desiring a less rigorous treatment. Suggested for nonchemistry majors.

physical effects which attend or alter chemical reactions. Topics considered are the gaseous and liquid states, chemical thermodynamics, properties of solutions, chemical equilibria, phase equilibria, kinetic theory, chemical kinetics, electrochemistry, and ionic equilibria. Three recitations per week. Credit may not be received for both S730 and S811. *Prereq: S101-102, S104; Coreq: S203, M211.*

S732 INTRODUCTORY ORGANIC CHEMISTRY. *Three Sem Hrs (3-0).* A study of the more important classes of carbon compounds and reactions of their functional groups. Relation of chemical and physical properties to molecular structure is considered with emphasis on bond types and structural effects. *Prereq: S102.*

S740 INTRODUCTION TO ACTIVE CIRCUITS. *Four Sem Hrs (3-2.)* Ideal diode applications. Solid-state diode and transistor theory. Basic transistor amplifiers: Class A, R-C and transformer coupled; tuned voltage amplifiers; Class B push-pull, complementary symmetry; emitter follower. Amplifier response characteristics, distortion analysis, feedback. Switching mode operation: waveshaping, function generators, basic digital circuits.

Note. This course pursues real circuit operation vice generalized circuit analysis although topics are selected to emphasize wide functional applications. The time domain treatment of the first course is continued without reliance on complex frequency and operational calculus.

S741 ELECTRONICS. *Four Sem Hrs (3-2).* Class C operation of electronic devices. Oscillators. Modulation and demodulation. Frequency multiplication and translation, the principle of the super-heterodyne receiver and the heterodyne frequency meter. Typical data transmission and communication systems. Noise and bandwidth considerations in communication systems. Fundamental electronic circuits applied to measurement and data display. The electronic voltmeter, the phase meter and typical bridge circuit techniques for the measurement of voltage, current, impedance and frequency.

S811 & S812 PHYSICAL CHEMISTRY I AND II. *Four Sem Hrs First Term (3-3); Five Sem Hrs Second Term (3-6).* An introduction to such topics as: Physical states of matter, kinetic theory of gases and liquids, the first and second law of thermodynamics, free energy, and spontaneity of chemical reactions, phase equilibrium, properties of solutions, chemical kinetics, electrochemistry, elementary quantum theory, and atomic and molecular structure. Three recitations and two 3-hour laboratory periods per week. *Prereq: S102, S202, S714. M220.*

S813 ORGANIC CHEMISTRY III. *Three Sem Hrs (1-6).* Synthetic methods and discussion of important theories of organic chemistry—a continuation of S605-606. Methods of qualitative organic

analysis will also be covered. The laboratory work will emphasize systematic methods for separation and identification of organic compounds. *Prereq: S606.*

S814 ANALYTICAL CHEMISTRY II. *Four Sem Hrs (2-6).* This course is a continuation of Chemistry S714. The theory and application of modern instrumental methods of analysis will be stressed. Two recitations and two 3-hour laboratory periods per week. *Prereq: S714.*

S815 ADVANCED INORGANIC CHEMISTRY II. *Three Sem Hrs (3-0).* This course is a continuation of Chemistry S713. The following topics are considered: complex ions and coordination compounds, organometallic compounds, carbonyl compounds, boron hydrides, isopoly and heteropolymolybdates and tungstates, reactions in nonaqueous media, and items of interest in the recent chemical literature. Reaction kinetics and reactions mechanisms are considered. *Prereq: S713.*

S816 BIOCHEMISTRY. *Three Sem Hrs (3-0).* An introductory course in human biological chemistry which will include a detailed study of the chemistry of proteins, carbohydrates, and fats, tissue, enzymes, digestion, physiological oxidations, energy, metabolism (both normal and abnormal) respiration and acid-base balance, water and trace mineral paths. The physiological role of vitamins and hormones will be considered and chemical analysis of blood, milk and urine will be included. Modern radioisotope techniques will be discussed. *Prereq: S102, S605.*

S818 CATALYSIS. *Three Sem Hrs (3-0).* A study of adsorption, kinetics of surface catalysis, promoters, accelerators, catalyst poisons, homogeneous catalysis and the application of catalysis to industrial processes. Three recitations per week. *Prereq: S812.*

S820 ELECTROCHEMISTRY. *Three Sem Hrs (3-0).* A study of electrolytic conductance, ion migration, electrode potentials, the deposition and corrosion of metals, and electrokinetic phenomena in terms of the physiochemical properties of electrolyte systems. Three recitations per week. *Prereq: S812.*

S821 THEORETICAL PHYSICS III. *Three Sem Hrs (3-0).* Physical optics. This course continues from Theoretical Physics II and considers the propagation of electromagnetic waves. The topics of reflection, refraction, dispersion, interference, diffraction, polarization, scattering, and absorption are studied. *Prereq: S722.*

S822 THEORETICAL PHYSICS IV. *Three Sem Hrs (3-0).* Introduction to kinetic theory, thermodynamics, and statistical mechanics. The last part of the sequence in theoretical physics is an intro-

duction to three different approaches to related physical problems. Thermodynamics is developed from the first two laws through the Maxwell relations and the Gibbs phase rule. The Boltzmann and Maxwell distributions are developed and their applications and limitations considered. Finally, the concepts of quantum statistics are introduced. *Prereq: S821.*

S823 LABORATORY PHYSICS III. *One Sem Hr (0-2).* The laboratory is closely related to the classwork of course S821 and includes experiments with both visible light and microwaves. *Prereq: S724.*

S824 LABORATORY PHYSICS IV. *One Sem Hr (0-2).* The experiments are drawn from the fields of atomic and nuclear physics. Some topics are Planck's constant, photoelectric effect, nuclear magnetic resonance, scintillation counting, and nuclear emulsions. *Prereq: S823.*

S825 PHYSICS SEMINAR I. *One Sem Hr (1-0).* A seminar with topics selected from classical physics. *Prereq: S722.*

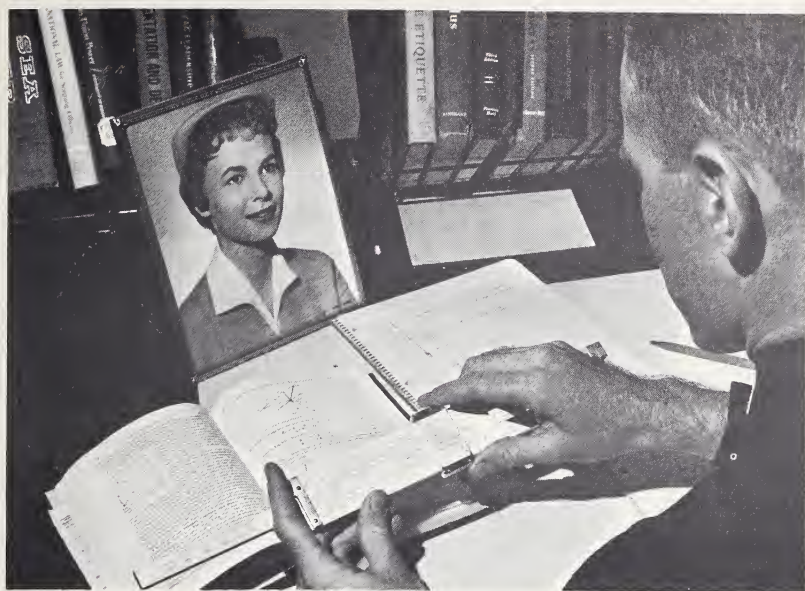
S826 PHYSICS SEMINAR II. *One Sem Hr (1-0).* A seminar with topics selected from modern physics. *Prereq: S825.*

S827 NUCLEAR SCIENCE I. *Three Sem Hrs (3-0).* From an introduction to the fundamental concepts of atomic and nuclear structure this course considers nuclear processes and the properties of nuclear radiations. Topics given emphasis are neutron physics, nuclear fission, the interaction of nuclear radiations with matter and the measurement systems required to determine the type and intensity of these radiations. *Prereq: S206.*

S828 NUCLEAR SCIENCE II. *Three Sem Hrs (3-0).* This course studies the applications of nuclear radiations and nuclear energy, developed in Nuclear Science I, for power production, research, and nuclear weapons. Included are a study of fusion, isotopes, the various types of nuclear reactors, and a summary of the important aspects of national nuclear technology programs. *Prereq: S827.*

S830 PHYSICS OF SOLIDS. *Three Sem Hrs (3-0).* This is an introductory course in physics of the solid states. The topics to be included are: crystal structures, thermal properties of solids, dielectric properties of solids, free electron model of metals, band theory of solids, magnetism and magnetic resonance, and semiconductors. *Prereq: S701.*

S840 NETWORK ANALYSIS. *Four Sem Hrs (3-2).* The development of mathematical models to represent electrical and mechanical networks. Solutions within the framework of the model. Physical interpretation of the solution and presentation of this interpretation in the most useful form. The study of Linear Algebra, determinants and matrices. Network topology including cut-set and tie-set matrices.



Equilibrium equations, two-part networks, application of two-part theory to active networks with emphasis on the effects of feedback. Use of digital computer facility for solution of problems will be emphasized. *Prereq: S740, M802.*

S841 ENERGY CONVERSION. *Four Sem Hrs (3-2).* Conservation of energy and the energy balance in electromechanical devices. Efficiency and losses; energy storage in electrical and mechanical systems. Electrical machines as information transducers, transfer functions, motional impedance. Electromechanical amplifiers. Transformers. Transfer functions of typical devices. *Prereq: S840, M802.*

S842 SOLID STATE. *Three Sem Hrs (3-0).* An introduction to the theory of a wide variety of solid-state phenomena which are directly and indirectly applied in modern electronics. Structure and behavior of metals, conductivity and ferromagnetism band theory of semiconductors; transistor devices. Gaseous conduction. *Prereq: S203, M211, M220.*

S843 DIGITAL TECHNIQUES. *Four Sem Hrs (3-2).* Elements of logical design. Digital transistor circuits. Memory systems. Analog-to-digital and digital-to-analog techniques. Current digital computer technology. Current digital communications technology. *Prereq: S840, S842.*

S844 ELECTRONIC INSTRUMENTS AND MEASUREMENT. *Four Sem Hrs (2-4).* Fundamental measurement and indicating devices. D'Arsonval voltmeter, ammeter, and electronic voltmeter. In-

strument calibration and response. Comparison methods for measurement of voltage, resistance, impedance, and frequency. Transducers for various physical measurements. The elements of digital measurement and display. Automatic data, readout, recording, and processing. Instrument servo systems, the X-Y plotter, strip chart recorder, magnetic tape, punched tape and punched card data storage. Statistical considerations in instrument readout and data processing. *Prereq: S843.*

S845 ELECTROMECHANICS. *Four Sem Hrs (3-2).* (This is a "service" course offered in the event that other departments wish to require a term of electromechanics beyond the 1-year core Electrical Science, S305 and S306. As such, course content will be adjusted to satisfy stated requirements.)

Generalized theory of electromechanical devices and elementary systems, including control system devices and information transducers, as well as motors and generators. Elements of automatic control: transient behavior, frequency response, stability. *Prereq: S306.*

S846 ELECTRONIC APPLICATIONS. *Three Sem Hrs (3-0).* This is a "service" course, offered in the event that other departments wish to require some study of basic electronics, since virtually no electronics is included in core courses S305 and S306. It will be comparable to S740, Introduction to Active Circuits, but topical coverage will be adjusted to satisfy stated requirements. *Prereq: S306.*

S847 INSTRUMENTATION AND MEASUREMENT. *Four Sem Hrs (2-4).* This is a "service" course offered in the event that other departments wish to require specific study in electrical/electronic instrumentation and measurement. It will be comparable to S844, Electronic Instruments and Measurement, but topical coverage will be adjusted to satisfy stated requirements. *Prereq: S846.*

S848 MICROWAVE THEORY. *Three Sem Hrs (3-0).* Waveguides, antennas, amplifiers, oscillators, pulse modulation. Correlation of current and prior studies in the analysis of a generalized radar system. *Prereq: S710.*

S849 INFORMATION THEORY. *Three Sem Hrs (3-0).* Concepts of information content, processes, errors, coding, and system capacity. Modulation, noise, and bandwidth considerations. Application to digital processes, as well as continuous signal processes. *Prereq: S843.*

S850 DIGITAL APPLICATIONS. *Four Sem Hrs (2-4).* The study and analysis of an automated digital data system, including computer, processing devices, and data communication subsystem. A current tactical data system will be selected as the course subject. *Prereq: S843.*

Weapons Department

Head of Department: Captain A. H. McCain; **Executive Officer:** Commander C. F. Martin; **Academic Advisor:** Associate Professor J. W. Neil; **Commanders:** G. G. Bailey, R. Ennis, C. G. Erb, W. S. Gabriel, J. F. Murphy, D. Taylor, Jr.; **Associate Professors:** J. F. Hoffman, W. J. Smith, E. J. Waller; **Lieutenant Commanders/Majors, USMC:** G. L. Apted, E. D. Geiger, E. W. Hays, J. H. Higgins, R. W. Hine, E. F. Jardine, Jr., D. B. Polatty, W. J. Ricci, D. P. Roane, C. E. Seeger, D. G. Todaro, W. J. Wysocki, W. B. Duncan; **Assistant Professors:** T. H. Miller, R. Muksian; **Lieutenants/Captains, USMC:** H. G. McAvenia, Jr., B. B. Williams, R. L. Belli, J. C. Gonzalez, E. B. Russell.

Objective

The objective of the department is to provide every midshipman with additional engineering background essential to an understanding of the principles that underlie all modern naval weapons systems; to provide a minors program for those midshipmen who show a particular interest in pursuing the study of naval weapons in depth, with additional background which would be beneficial to graduate study; and to offer a majors program of sufficient electives to maximize the undergraduate academic potential of the individual midshipman in his field of interest.

Facilities

Computing Center. The Computing Center, located with the Weapons Department in Ward Hall, provides for both analog and digital computation.

Digital Equipment available includes: One International Business Machine Corp. 1620 Model One Digital Computer with IMB 1311 Disk Drive and Pack. This is a general purpose, all transistorized computer with 20,000 magnetic core storage positions. The disk unit allows for 2 million additional digits for utility, storage, and monitor systems for use in program processing. In addition to basic machine language programing, automatic coding software includes: AFIT, GOTRAN, FORTRAN with FORMAT, FORTRAN IID, and Symbolic Programming System.

Input to the computer is either through a typewriter, with manual input, or Card Reader (IBM 1622 Card Read Punch Unit) capable of reading 250 cards per minute. Output is either typewriter at 10 characters per second or punched card (IBM 1622) at the rate of 125 cards per minute. Special programs and process routines may be stored on the disk and executed directly from the disk. Auxiliary equipment includes four IBM 026 Printing Key Punch Units for use in preparing program and data cards for processing.

Analog Equipment includes: Six basic partially expanded Electronics Associates, Inc., Precision Analog Solid State Electronic Computers TR-10 Model and one fully expanded computer. These units are available for a variety of applications in problem solving, simulation and research studies, and are mounded on mobile stands to increase their utilization.

Auxiliary Equipment includes: X-Y and time strip plotters for recording output data from computers.

In addition to the major equipments described above, the Computing Center has available special equipment for student-faculty projects. These include Digi-Labs, Mini-Vac Programming Machines, special modules of adaptive equipment for Analog-to-Digital Processing, logic study equipments, and a computer process trainer.

Explosives Laboratory: Laboratory facilities provide for miniaturized studies in explosive processes and effects. Special equipments developed by the Weapons Department provides for rocket thrust stand testing, dispersion test and study, observation and test of explosive blast effects, strength test of explosives using Trauzel blocks, vacuum cone study, ballistics range testing, metal forming by explosives, and shaped charge study.

Servomechanism Laboratory: Laboratory facilities include special servomechanism study panels developed and manufactured by the Weapons Department technical staff. Recording and measuring devices are available with each panel to support the basic equipments. The panels permit the student to solve a variety of problems related to their studies in weapons control systems.

Special Laboratories: In support of midshipman and faculty research, electronic, photographic chemistry, and special project laboratories are available within the Weapons Department.

Classroom Television: A closed-circuit classroom television installation provides live and taped programs to 12 classrooms. A single studio and two remotely located terminals are available for television programing with two mobile camera units.

Core Courses

- W300 Introduction to Digital Computers
- W409 Fire Control Systems
- W410 Control Systems Analysis and Simulation (For those midshipmen taking a minor in Science and Engineering)
- W412 Terminal Ballistics (For all midshipmen except those taking a minor in Weapons, Science or Engineering)

Majors-Minors Program

Systems Engineering (Weapons)

Required Courses

- | | |
|--|-------------------------------------|
| W211 Introduction to Systems (Weapons) | W351 Analog and Digital Computation |
| W312 Principles of Control (Weapons) | W432 Systems Design |
| W332 Linear Systems Analysis | S741 Electronics |

Elective Courses

Systems Engineering Minor selects *two* courses and Systems Engineering Major selects *five* courses from the following:

- | | |
|-----------------------------------|--|
| W904 Independent Study/Project | W951 Applications of Computer Technology |
| W931 Automatic Control Systems I | M606 Probability and Statistics II |
| W932 Automatic Control Systems II | S710 Electromagnetic Waves |
| W933 Digital Technology | M671 Linear Programming |
| W934 Sampled-Data Control Systems | |

Additional courses from other technical departments are used to complement Weapons Department electives in the Systems Engineering (Weapons) Majors Program (e.g., M606, M751, and others as selected by the midshipman with the approval of the faculty adviser).



Digital Computing System IBM 620

Fire Control Director



Course Descriptions

W211 INTRODUCTION TO SYSTEMS (WEAPONS). *Four Sem Hrs (3-2).* To introduce the student to the Naval Weapons Systems concept and the basic theory involving system components, and to serve as an introduction to more advanced and detailed treatment of courses in the Weapons Systems sequence. The course includes a study of the warhead triad (fuzing, arming, safety), launching, propulsion and control systems, with laboratory instruction in (a) ballistic dispersion; (b) explosive testing, handling, and safety precautions; (c) rocket-thrust determination; and (d) blast and shock effects.

W300 INTRODUCTION TO DIGITAL COMPUTERS. *One-Half Sem Hr ($\frac{1}{2}$ -0).* An introduction to the philosophy and use of modern digital computers including military, industrial, scientific, and business applications. Basic functions of the computer are considered, including practical use of FORTRAN (Formula Translation) language to process student computer programs on the IBM 1620 Digital Computer. A variety of programs are written on problems evolving from student studies in engineering and science. The student is encouraged to continue the use of the digital computer for solution of problems arising from his other course work.

W312 PRINCIPLES OF CONTROL (WEAPONS). *Four Sem Hrs (3-2).* A study of the generalized weapon system control problems which investigates relative motion and the forces acting on the missile in order to obtain a prediction angle. Subsequently, the instrumentation required for the solution to the problem is studied. Laboratory instruction is directed toward digital, analog and hybrid computers, and sensing devices used to solve for the prediction angle. *Prereq: M30.*

W332 LINEAR SYSTEMS ANALYSIS. *Three Sem Hrs (3-0).* Formulation, solution, interpretation of the integro-differential equations which describe the response of physical systems. Such systems are combinations of mechanical, electrical, and hydraulic subsystems. Topics include operational methods, transfer functions, linearization, formulation of equations from mechanical and electrical concepts, and Laplace and Fourier transform methods. The input-output response techniques are stressed and an engineering approach is used. *Prereq: M200.*

W351 ANALOG AND DIGITAL COMPUTATION. *Three Sem Hrs (3-0).* A study of the solution of general engineering and applied problems on modern electronic digital and analog computers. The course includes solution of problems by modern numerical, mathe-

matical, and and simulation methods using current digital computers and analog techniques. *Taken concurrently with M220.*

W409 FIRE CONTROL SYSTEMS. *Four Sem Hrs (3-2).* An introduction to fire control systems, weapon control analytics, predictions, flight path analysis, and trajectories. The solution of the fire control problem is included, plus warhead (fusing, safety, and arming). Laboratory instruction is directed towards the simulation of the fire control problem. *Prereq: M305.*

W410 CONTROL SYSTEMS ANALYSIS AND SIMULATION. *Four Sem Hrs (3-2).* Analysis of linear automatic control systems using analytical, graphical, and analog techniques. Formulation of the control system equation and transfer function. Steady state and transient system response. Graphical methods of system analysis including root locus, Bode plot and Nichol's chart. System compensation by frequency response methods. Laboratory application of automatic controls will support the classroom development. *Prereq: M220 and one of the following: E809, S840, S841.*

W412 TERMINAL BALLISTICS. *Four Sem Hrs (3-2).* Principles of terminal ballistics including target characteristics, weapon systems effectiveness, design and testing, damage criteria, theory of chemical and nuclear explosives, basic warhead and fuze design, and the application of reaction propulsion. The course applies such basic tools as statistics, mechanics, and thermodynamics. Laboratory instruction covers probability, explosive testing, shock wave phenomena, and solid-rocket engine testing. *Prereq: M220.*

W432 SYSTEMS DESIGN (WEAPONS). *Four Sem Hrs (3-2).* The course emphasizes the systems concept that is so essential to the understanding of the whole system, be it man, machine, or both. Particular emphasis is placed upon the application of this concept to the development and operation of modern naval weapons systems. Among the topics covered are the system specification, development of system models, information theory, high traffic situations, reliability, human engineering, competitive systems, completion of design, and feasibility from the initiation of the specification to completion of the design. Laboratory applications of systems analysis, feasibility, and reliability, stressing practical applications of classroom principles. *Prereq: W332, S846.*

W904 INDEPENDENT STUDY/PROJECT. *Three Sem Hrs (3-0).* A creative, technical, independent study/project in an aspect of the weapons field in which the student has interest. Each project requires the student to have a Weapons Department Adviser. *Prereq:*

approval by the Head of Weapons Department, via Faculty Adviser, must be obtained prior to enrollment.

W931 AUTOMATIC CONTROL SYSTEMS I. *Four Sem Hrs (3-2).* Analysis of automatic control systems. Open and closed loop systems; formulation of transfer functions from physical systems including mechanical, electrical, and hydraulic components; and block diagrams and signal flow diagrams. Stability and complex frequency domain analysis. Introduction to design techniques. Laboratory applications of automatic controls will support the classroom development. *Prereq: W332.*

W932 AUTOMATIC CONTROL SYSTEMS II. *Four Sem Hrs (3-2).* Design of automatic control systems. Specification and performance criteria in real and frequency domain; pole zero synthesis and design using root locus. Introduction to optimum parameter synthesis. Effect of nonlinear components and nonlinear control system behavior, including piecewise linear analysis, describing-function methods, and phase-plane representation. Laboratory instruction in the simulation of linear and nonlinear systems. *Prereq: W931.*

W933 DIGITAL TECHNOLOGY. *Four Sem Hrs (3-2).* Fundamentals of logical design for digital circuitry including Boolean algebra, its use in symbolic logic and the analysis of basic logical circuits; qualitative description of basic electronic and semiconductor devices; construction of computer circuits in the laboratory using tubes and transistors. Instruction is devoted to models for switching networks, synthesis of switching circuits, memory devices, and machine-aided logical design. *Prereq: W351.*

W934 SAMPLED-DATA CONTROL SYSTEMS. *Four Sem Hrs (3-2).* The response of control systems to discrete input; basic theory of sampling, quantizing and data reconstruction; the Z-transformation and the Z-plane; stability of sampled-data feedback systems; compensation in the Z-plane. Practical application in laboratory work studying systems which are fed by discrete inputs. *Prereq: W931 or W933.*

W951 APPLICATIONS OF COMPUTER TECHNOLOGY. *Four Sem Hrs (3-2).* A study of the direct application of digital and analog techniques to solve problems arising in Weapons Systems. Design and operation. Methods for solving problems developed in earlier course work will be applied in working through a systems study from design through to the operational phase. A class project will be studied concurrently with the work in the classroom. *Prereq: W933.*

PRIZES, AWARDS, AND DISTINCTIONS

Each June Week more than 80 prizes and awards, provided by individuals and a wide variety of organizations, are presented to individual midshipmen in recognition of their noteworthy accomplishments in such areas as academics, leadership, professional studies, debate, public speaking, sailing, marksmanship, and athletics.



A Nautical Prize at Graduation

THE U.S. NAVAL ACADEMY ALUMNI ASSOCIATION

The U.S. Naval Academy Alumni Association, Inc., is a private organization whose mission is to serve and support the United States, the Naval Service, and the Naval Academy by furthering the highest standards of the Naval Academy; by seeking out, informing, encouraging, and assisting outstandingly qualified young men to pursue careers in the Navy and Marine Corps through the Naval Academy; and by initiating and sponsoring activities which will perpetuate the history, traditions, memories, and growth of the Naval Academy and bind alumni together in support of the highest ideals of command, citizenship, and government.

All alumni of the Naval Academy are eligible for membership in the association—graduates, nongraduates, active duty officers, retired officers, and resigned alumni.



The Alumni House

Alumni House (Ogle Hall of pre-Revolutionary Annapolis fame) is the association's distinguished national headquarters. Files and records are maintained on all ex-plebes dating from the establishment of the present Naval Academy in 1845 through the classes now enrolled. The many functions of the Association include annual publication of the *Register of Alumni*; publication of *Shipmate*, the alumni magazine; support of class and chapter organizations; and assistance and support to the Academy during Homecoming, Parents' Weekend, and June Week.

THE UNITED STATES NAVAL INSTITUTE

Headquartered in Annapolis, the United States Naval Institute is a voluntary, private, nonprofit association of more than 63,000 members formed in 1873 for "the advancement of professional, literary, and scientific knowledge in the Navy." The membership includes officers and enlisted personnel from all branches of the military services, distinguished officers of foreign navies, and U.S. citizens interested in American seapower. Members pay annual dues which entitle them to a year's subscription to the Institute's monthly, professional journal, *The United States Naval Institute Proceedings*. The journal is one of the most widely quoted and reprinted journals in the United States.

In addition to the *Proceedings*, the Institute publishes a large variety of books, including works on naval history and biographies of naval heroes as well as texts on professional naval subjects.



M. E. Warren

Bancroft Hall, Home of the Brigade of Midshipmen

ADMINISTRATION OF THE NAVAL ACADEMY

The administration of the Naval Academy is in many respects analogous to that of any college. A Board of Visitors performs the broad supervisory functions of a board of trustees. The Superintendent, like a college president, is the executive head of the Academy. He is assisted by an administrative staff; the Commandant of Midshipmen, whose function is somewhat like that of a dean of students; and the Academic Dean. The Superintendent, the Commandant, the Academic Dean, and other senior members of the faculty comprise the Academic Board, which makes major academic decisions and sets the academic standards for the Academy. Military indoctrination and physical training come under the Commandant. The faculty is organized into seven academic departments under the Academic Dean.

The Board of Visitors

A Board of Visitors to the Naval Academy is constituted annually of the chairman of the Committee on Armed Services of the U.S. Senate, or his designee; three other members of the Senate designated by the Vice President of the United States or the President *pro tempore* of the Senate, two of whom are members of the Committee on Appropriations of the Senate; the chairman of the Committee on Armed Services of the U.S. House of Representatives, or his designee; four other members of the House of Representatives, two of whom are members of the Committee on Appropriations of the House of Representatives; and six

persons designated by the President of the United States.

The Board meets annually at the Naval Academy to inquire into the state of morale and discipline, the curriculum, instruction, physical equipment, fiscal affairs, academic methods, and related matters and submits a written report of its action and its views and recommendations pertaining to the Naval Academy to the President of the United States.

The members of the 1965 Board of Visitors were:

Appointed by the President of the United States

Mr. Guy Stillman, Chairman

Consulting Engineer

Phoenix, Ariz.

Mr. Thomas J. Deegan, Jr.

Chairman, Thomas J. Deegan Co., Inc.

New York, N.Y.

Dr. Edwin D. Harrison

President, Georgia Institute of Technology

Atlanta, Ga.

Mr. David J. McDonald

President, United Steel Workers of America

Pittsburgh, Pa.

Dr. James Madison Nabrit, Jr.

President, Howard University

Washington, D.C.

Mr. Stanley M. Stalford

Chairman of the Board, Fidelity Bank

Beverly Hills, Calif.

Appointed by the Vice President

Senator Gale W. McGee, Wyoming

Senator James B. Pearson, Kansas

Senator A. Willis Robertson, Virginia

Appointed by the Speaker of the House

Representative Daniel J. Flood, 11th District of Pennsylvania

Representative Samuel N. Friedel, 7th District of Maryland

Representative Carleton J. King, 30th District of New York

Representative William E. Minshall, 23d District of Ohio

Ex Officio Members:

Senator Daniel B. Brewster, Maryland

(Designee of Senator Richard B. Russell, Chairman, Committee on Armed Services, U.S. Senate.)

Representative Samuel S. Stratton, New York

(Designee of Representative L. Mendel Rivers of South Carolina, Chairman, Committee on Armed Services of the U.S. House of Representatives.)

DIRECTORY OF STAFF AND FACULTY

Administration

Superintendent, Rear Admiral Draper L. Kauffman, USN; B.S., U.S. Naval Academy; U.S. Naval War College.

Commandant of Midshipmen, Captain Sheldon H. Kinney, USN; B.S., U.S. Naval Academy; J. D., George Washington University; National War College.

Academic Dean, Dean A. Bernard Drought; B.E., Milwaukee State Teacher's College; M.A., Northwestern University; M.S., and S.D., Harvard University.

Director of Administration and Logistics, Captain Emil Saroch, Jr., USN; B.S., U.S. Naval Academy.

Director of Athletics, Captain Alan B. Cameron, USN; B.S., U.S. Naval Academy; U.S. Naval War College; Industrial College of the Armed Forces.

Dean of Admissions, Senior Professor William S. Shields; A.B., M.A., Ph. D., Western Reserve University; University of Paris; Navy Japanese Language School.

Senior Chaplain, Captain James E. Reaves (CHC), USN; B.A., B.D., Southern Methodist University; M.A., Columbia University.

Superintendent's Staff

Aide to the Superintendent: Captain Emil Saroch, Jr., USN; B.S., U.S. Naval Academy.

Executive Assistant and Aide: Commander Frank Cramblet, USN; B.S., U.S. Naval Academy; M.S., U.S. Naval Postgraduate School.

Flag Secretary and Aide: Lieutenant Commander Stewart D. Landersman, USN; A.B., Dakota Wesleyan University.

Director of Administration and Logistics

Director: Captain Emil Saroch, Jr., USN, B.S. Naval Academy.

Chaplain Department

Chaplain: Captain James E. Reaves (CHC), USN; B.A., B.D., Southern Methodist University; M.A., Columbia University.



Jack Engeman

Departmental Staff:

Commander Ernest R. Lineberger, Jr. (CHC), USN; A.B., Lenoir Rhyne College; B.D., Lutheran Theological Southern Seminary.

Lieutenant Commander Patrick F. Sweeney (CHC), USNR; B.A., Holy Cross College; S.T.B., Grand Seminary, Montreal.

Commander Mark P. Sullivan (CHC), USN; B.A., Holy Cross College; M.S. in Ed., Fordham University; S.T.B., St. John's Seminary.

Lieutenant Lowell W. Van Tassell (CHC), USN; B.S., Kansas State College; B.D., Louisville Presbyterian Theological Seminary.

Personnel and Administrative Officer: Commander Charles M. Johnson, Jr., USN; B.S., U.S. Naval Academy.

Comptroller: Commander Harold R. Tall, USN; B.S., U.S. Merchant Marine Academy; M.A., George Washington University.

Security and Plans Officer: Commander Edmund J. Treacy, USN; B.S., U.S. Naval Academy; B.S., U.S. Naval Postgraduate School.

Management Engineer: Colonel William K. Davenport, USMC (Ret); B.S., U.S. Naval Academy; M.S., George Washington University; Command and General Staff School; Industrial College of the Armed Forces.

Public Information and Photographic Officer: Commander Kenneth W. Moorhead, USN; B.S.C., Central YMCA College, Chicago, Ill.; M.S., Boston University.

Legal and Legal Assistance Officer: Captain Paul F. Borden, USN; LL.B., National University.

Visitor Services Officer: Lieutenant Commander Irwin Patch, Jr., USN; B.S., U.S. Naval Academy.

Communications Officer: Lieutenant Jack A. Vivian, USN.

Assistant Public Information and Training Aids Officer: Lieutenant (jg.) Garner S. Hill II, USNR; B.A., Princeton; M.B.A., Columbia University.

Supply and Fiscal Officer: Captain Randolph Meade, Jr. (SC), USN; B.S., U.S. Naval Academy.

Public Works Officer: Captain Albert R. Marschall (CEC), USN; B.S., U.S. Naval Academy; B.C.E., M.C.E., Rensselaer Polytechnic Institute; P.E.

Industrial Relations Officer: Mr. Frank P. Bruther.

Naval Academy Museum

Director: Captain Dayle Mayberry, USN (Ret); B.S., U.S. Naval Academy; M.A., Stanford University; M.A., George Washington University.

Admissions, Publications and Records

Dean of Admissions: Senior Professor William S. Shields, A.B., M.A., Ph. D., Western Reserve University; University of Paris; Navy Japanese Language School.

Assistant Dean of Admissions: Mr. Wilbur H. McNew, Jr.

Candidate Guidance Officer: Lieutenant Commander Frederic J. Thomas, USN; B.S., U.S. Naval Academy.

Publications Officer: Mr. Edward P. Wilson, Jr.; B.S., U.S. Naval Academy.

Registrar: Professor Edward T. Heise; B.A., St. John's College; M.A., Johns Hopkins University.

Assistant Registrar: Mr. James F. Kimball.



M. E. Warren

Commandant of Midshipmen

Commandant. Sheldon H. Kinney, Captain, USN; B.S., U.S. Naval Academy; J.D., George Washington University; National War College.

Deputy Commandant/Head of Executive Department. Kenneth B. Brown, Captain, USN; B.S., U.S. Naval Academy; U.S. Naval War College.

Head, Physical Education Department. Alan R. Cameron, Captain, USN; B.S., U.S. Naval Academy; U.S. Naval War College; Industrial College of the Armed Forces.

Head, Medical Department. Joseph A. Syslo, Captain, MC, USN; B.S., M.D., Loyola University School of Medicine.

Head, Dental Department. William R. Stanmeyer, Captain, DC, USN; B.S., D.D.D., University of Illinois.

Head, Midshipmen Services Activities Department. Randolph Meade, Jr., Captain, (SC), USN; B.S., U.S. Naval Academy.

Executive Department

Head of Department. Kenneth B. Brown, Captain, USN; B.S., U.S. Naval Academy; U.S. Naval War College.

Departmental Staff:

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Nuclear Submarine

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